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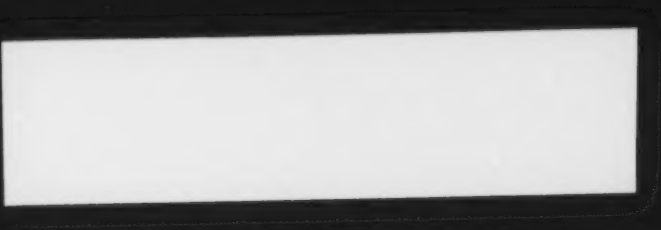
ABSTRACT

These materials supplement state guides for junior high or middle school technology education programs. The materials show instructors how to implement 81 hours of new technology-related activities into existing programs. Introductory materials include a rationale, philosophy, and goals for technology education. Areas of instruction are as follows: (1) transportation; (2) communication; (3) manufacturing; (4) power and energy; (5) construction; and (6) miscellaneous. Each activity may contain the following: a description of the activity; a list of equipment and supplies needed; instructor information; construction procedures; testing and evaluation sections; follow-up activities; goals and objectives; diagrams; and resource information. The transportation unit contains instructions concerning the following activities: carbon dioxide powered race cars; rubber band vehicle; balloon powered vehicle; marshmallow thrower; and boat hull design and testing. Communication activities deal with the following CADDRAW software: operation board; evolution board; safety news article; electronic publishing; and product advertising. Section 3 describes the following manufacturing activities: workhardening; computer-aided manufacturing; corrosion and oxidation of steel; and The Bookmark Factory. Power and energy activities focus on the following: solar collector; electrical conductivity of wood; soft soldering; heat conductivity of steel; and dielectric testing. Section 5 explores load-bearing structures and wood strength. Section 6 contains a job application activity. An annotated bibliography lists 22 technology education curriculum materials and 25 activities. (NLA)



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MIDDLE SCHOOL
INDUSTRIAL ARTS/TECHNOLOGY EDUCATION
CURRICULUM PROJECT

OREGON DEPARTMENT OF EDUCATION
DIVISION OF
VOCATIONAL EDUCATION
IN COOPERATION WITH
PORTLAND PUBLIC SCHOOLS

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T & I TECHNOLOGY EDUCATION

1988-89

INTRODUCTION TO:

SELECTED TECHNOLOGY LAB ACTIVITIES

PURPOSE & USE OF THIS GUIDE:

These materials are not intended to be a whole curriculum for junior high or middle school Technology Education programs. The intended use and purpose is a beginning supplement to current state guides; to show instructors how they might implement new technology-related activities into already existing Industrial Arts programs or into a new and emerging Technology Education program.

Reference is made in the bibliography as to other excellent and acceptable curriculum materials to assist you in implementing the new curriculum models.

These materials will provide you with a total of approximately 81 hours of instruction that is broken down in the following areas of instruction:

Transportation	36 hours	
Communication	22 hours	
Manufacturing	7.5 hours	-- Equates to approximately 16 weeks
Power & Energy	12.5 hours	
Construction	3 hours	

It is hoped that these materials will be a stimulus to the instructor to develop their own materials, or find the desire to research other sources of curriculum materials, and to become involved with the International Technology Education Association and their documents for curriculum improvement.

Curriculum change in these areas should be everchanging and seeking new ideas, frontiers, and heights.

For more information, contact the Technology Education Specialist at the Oregon Department of Education, 378-5114.

MIDDLE SCHOOL
INDUSTRIAL ARTS/TECHNOLOGY EDUCATION

CURRICULUM PROJECT

This project was funded by the Oregon Department of Education in cooperation with Portland Public Schools who provided matching funds to the State Curriculum Improvement Grant.

The purpose of this project was to develop a philosophy and set of goals for Technology Education along with lab activities (TLAs). It is intended to be used in implementing technology in the junior high/middle high Industrial Arts/Technology Education programs. The main goals are to provide hands on materials for the instructors to implement change within their programs in line with state and national directions in Technology Education, and to provide updated curriculum support for existing state guides.

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CITE ACTIVITIES:

Center for Implementing Technology Education
(Ball State University)

INDUSTRIAL ARTS/TECHNOLOGY EDUCATION

Rationale:

The Society is demanding that students be prepared for a working world that is technologically advancing faster than society can predict. Employers are calling for a broader approach to career education that allows students to learn skills and concepts necessary for success and adaptability in future vocational and avocational pursuits.

Employers and researchers have defined these skills and have asked educators to develop programs that emphasize application of academic skills, thinking skills, decision-making skills, and good working habits. The Industrial Arts/Technology Education program emphasizes the learning of "interdisciplinary concepts" with a hands-on approach.

In support, excerpted from Portland Schools middle school study project.

> "The middle school curriculum balances continued growth in basic skills with exploratory experiences. Intellectual development, creativity, and curiosity should be fostered. Exploratory opportunities should be made available in a variety of subject areas in order to help students discover and expand their interest and talents. Career awareness activities should be offered and students should begin to acquire those skills necessary for adaptation in a rapidly changing technological society."
>
> Portland Public Schools
>
> From: Middle School Study
> Interim Report
> April 15, 1987

Philosophy:

Industrial Arts/Technology Education is a comprehensive activity--based education program for all students. This philosophy addresses technology (its evolution, utilization, and significance), industry (its organization, personnel, systems, techniques, resources, and products), and the social/cultural impact.

Industrial Arts/Technology Education emphasizes "exploration" of technology. It enables the students to:

- Appreciate the importance of technology
- Apply tools, materials, processes, and techniques
- Apply and transfer concepts
- Make informed career choices
- Discover and develop individual talents
- Apply creative abilities
- Deal with forces that have influenced the past, present, and will influence the future
- Adjust to a changing environment
- Develop vocational activities and become a wiser consumer

The Industrial Arts/Technology Education program reinforces the basic "academic skills" (reading, writing, math, scientific methods and laws, and social developments) by HANDS-ON EXPERIENCE and by the APPLICATION of these skills and concepts.

The program insists on safe working habits and develops safety consciousness in or out of the technology laboratory. Its structure develops individual responsibility, such as positive work attitudes, good attendance, leadership, cooperation, and time management.

Industrial Arts/Technology Education develops HIGHER ORDER OF THINKING SKILLS by allowing students to: explore, use decision-making processes, do creative thinking, transfer academic learning to practical application, and organize and apply teamwork to accomplish best results.

Industrial Arts/Technology Education will produce individuals who can participate and adapt to a dynamic industrial and technological society consistent with their abilities, interests, and needs.

I. Industrial Arts/Technology Education Goals

The teaching goals for Industrial Arts/Technology Education need to be centered around a set of major concepts. The knowledge and application of these concepts are considered fundamental to being technologically literate. Here are some suggested goals.

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

2. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

3. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

4. Explore and develop understanding of the systems of technology, how systems are controlled and how systems are used to solve problems.

5. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

II. Major Occupational Areas

1. Communications Technology
2. Construction Technology
3. Production Technology
4. Transportation Technology
5. Energy Utilization Technology

III. Essential Learning Constants in Technology Education

1. Systems of technology
2. Mathematics concepts
3. Science concepts
4. Awareness of human elements of technology-societal implications
5. Communications skills
6. Safety and health
7. Psychomotor skills
8. Career-related information
9. Creative problem solving
10. Transfer of learning

In continuum and support of previous statements, the following was excerpted from the State Technology Education Assessment Instrument.

Through Hands-On Activities, Students Will Be Able To:

1. Develop insights of industry and technology and their impact on our culture as a user of technology, consumer of technology.

2. Discover and develop talents, attitudes, and interests related to industrial or technical areas.

3. Develop abilities in the proper use of tools, machines, processes, and materials.

4. Develop problem-solving skills using the tools, materials, products, and information of industry.

5. Apply the content of (technology) to other school subjects in the curriculum.

6. Develop an understanding of a variety of careers and their requirements.

7. Acquire knowledge and develop skills to manage personal resources related to industry and technology.

8. Perform work in a manner safe to themselves and others.

9. Apply the content of other school subjects to industrial technology curriculum and problem solving.

10. Develop skills and styles for being a decision-maker about and with technology.

11. Develop attitudes and insights to being a lifelong learner as a citizen involved in and concerned about the future as technology affects changes.

12. Trace development of technology and relate to future forecasts for industry and technology.

SECTION 1

TRANSPORTATION ACTIVITIES (TLA)

ACTIVITY TITLE:

CO_2 POWERED RACE CARS

Description of Activity:

In this activity students design, construct, test, and race vehicles powered by a CO_2 cartridge. The cars are run on a raceway that starts the cars by puncturing the CO_2 cartridge and the car is guided by a fish line to the finish gate. It provides an opportunity to explore the forces that act upon a moving vehicle and how design effects performance. The culmination of the activity is for students to race their cars against each other in a drag race style event.

Time Needed For This Activity: 15-20 Classroom Hours

Occupational Areas: (circle one)

Construction
Communication
**Power & Energy
Manufacturing
**Transportation

Equipment & Supplies Necessary For This Activity:

Tools and Shop Supplies: Scissors, masking tape, carbon paper, Exacto knives, drill press, band saw, C-clamps, 3/4" spade bit, cabinet file, half-round wood rasps, 3/16" twist drill, course-medium-fine sandpaper, powered graphite, spray paint or brush paints for finishing.

Available From Pitsco: The student instruction booklets Race Car and Aerodynamics in Junior Engineering contain all needed information on design, construction, and testing of a CO_2 car.

CO_2 Race Car Kit (available as prepackaged kit or in bulk parts for assembly) contains: wheels, axles, plastic straw, screw eyes, washers, CO_2 cartridge, basswood body blank, styrofoam blank, and instruction booklet.

Race Track: The race track is available in parts to assemble, in a fully-assembled manual start track, or a computer controlled start and timing system.

Instructor Information: CO_2 Race Cars

Most of the information on design and construction is contained in the instruction booklet Race Car available from Pitsco. Page numbers in this section are referring to this publication.

1. Design & Problem Solving: (instructional time 5-8 class periods)

   Instructional areas to be explored:

   a. The design/problem-solving process: The instruction booklet (pages 2-3) gives the student an overview of the design process. In discussing this information, it works well to bring up such questions as: How does this process relate to the problem-solving process? What information do we need before we can start designing? How do we evaluate our designs?

b. Design limitations: Information on design limitations is provided on pages 4 and 5. It is good to review with students the basic limitation of the materials by showing them the supplies that will come in their kit. In reviewing the specifications, it is helpful to have them identify the given limitations (such as the size of the CO_2 cartridge hole) and flexible limitations (such as the wheelbase). At this time, the students can also be presented with factors that will effect performance and can be controlled through design and construction, such as: aerodynamics, weight, friction, wheel alignment, surface finish, etc.

c. Two view drawings (top & side views): By showing the students examples of car designs, it is easy for them to see that the top view and side view of the car are two different, but related, designs. When students start their thumbnail sketches, I have them draw a minimum of four top views and four side views. Next, the students choose from their thumbnail sketches and develop three designs which include a top and side view (pages 8-11). Of these three, they choose one design which is drawn full size with both the top and side view. It is easy for them to see that if certain information (such as axle hole location or body length) does not line up in both views, they will have trouble constructing the vehicle.

d. Prototyping or modeling: The instructions for making a prototype are given on pages 14 and 15. The students are provided with a styrofoam blank to construct a model of their design. This step is helpful because it gives the students an opportunity to go through the construction process with an easy-to-use material and thereby reduce the number of mistakes made in final production. It also shows them the value of modeling as part of the design process. Seldom does industry go directly from drawings to production. Many times after prototyping a student will change his design in order to reduce production problems or get a more desired outcome.

2. Construction: (instructional time 5-8 class periods)

The instructions for the final production of the car are given on pages 16-22 in the instruction booklet. If you purchase the predrilled body blanks from Pitsco, they come cut to size and the CO_2 cartridge hole drilled in the back. If you are using your own body blanks, it is best to construct a jig that will properly locate the hole and hold the blank steady during drilling.

For best results during production, I have students use a try square to transfer and draw the actual location of the CO_2 cartridge hole on the side and top of the blank. This will help them to line up their patterns correctly and ensure that they will not cut into the CO_2 cartridge hole when sawing.

After the student has transferred his design onto the blank, it should be checked that the length and location of the axle holes are the same in both the top view and the side view. Many times some adjustment has to be made so that everything will line up properly.

Make sure that students drill their axle holes before they cut out their design. It is difficult to drill after it is cut and the accuracy of the hole will determine how straight the car will roll. When the students cut out their cars, they should start by cutting the side view. This usually results in the fewest number of pieces to be put back together for cutting the top view.

During assembly, it is advisable to have on hand an extra supply of wheels and small part for replacement due to breakage or loss. Also, it is handy to have some Superglue handy to mend cracks or glue small pieces that break off during cutting or shaping.

3. Testing and Evaluation: (instructional time 5 class periods)

This gives the students an opportunity to explore how forces (such as drag or friction) will affect the performance of their design. There is generally high interest in how their results compare with others, so it is good to have a blackboard or other display area for them to record their results.

Most of the information for testing of the cars is contained in the booklet Wind Tunnel: Aerodynamics in Junior Engineering, available from Pitsco. All page references in the following section are referring to this publication.

a. Weight: The students will need a gram scale to accurately weigh their cars when completed. The final weight is determined with the car painted and completely assembled.

b. Aerodynamic testing: Aerodynamic and drag testing can be accomplished by using a wind tunnel. Pages 12 and 13 show using a wind tunnel that was sold by Pitsco, but is now no longer available. Plans for wind tunnels are available from a number of sources and could be constructed as a student project.

c. Inertia performance testing: Inertia performance and wheel alignment testing both require a testing ramp, which is simply an inclined surface for the car to roll down. The information for inertia testing is found on pages 16 and 17. The test is performed by rolling your car down the ramp and measuring the distance it rolls. Inertia performance is determined by dividing the distance traveled by the weight of the car.

d. Wheel alignment testing: To determine the wheel alignment accuracy the student again rolls his car down the testing ramp to see how straight it runs. You will need to have a center line established on the ramp and across the floor. The student then measures the distance traveled and the distance the car is off the center line when it stops. Accuracy is determined by dividing the distance traveled by the distance off center.

e. Time trials: In order to do time trials you will have to have a timing device that will give you elapsed time in seconds from start to finish. These cars go very fast and it is difficult to measure them with a stopwatch. Pitsco sells a "hair trigger" timer which is worth the investment if you are planning to make this an ongoing project with your classes. The time trials involve running each car on the 20 meter raceway, one at a time, in order to determine their time in seconds. This information is used to find average speed, maximum velocity, and to send the entries into the race schedule.

f. Average speed: The information needed to find average speed is found on pages 18 and 19. The solution is calculated in three steps to go from meters per second to miles per hour.

g. Maximum velocity: The information needed to find maximum velocity is found on pages 20 and 21. This formula takes into consideration the acceleration period as determined by the length of time it takes for a CO_2 cartridge to empty.

4. The Races: (instructional time 2-3 class periods)

The races are generally run using a double elimination schedule. This ensures that each student will race his car at least twice before it is eliminated. An example of a double elimination bracket is given inside the front cover of the Race Car instruction booklet.

At times, the races can be very close and it is difficult to determine which car is the winner. The hair trigger timer, sold by Pitsco, has a win indicator built into it which has a light that goes on above the lane of the winning car. They also sell a win indication device that does not include the timer.

5. Follow-Up Activities:

Race Car Display: After this activity, the race cars make a good display item for the showcase or library. The cars tend to draw the interest of other students and staff which is good recognition for your students and program.

Awards: The trouble with competitions is that while many participate, only a few win. While most students that complete a car feel successful, it is good to have other awards at the end of the unit to recognize good ideas or craftsmanship. Page 25 in the instruction booklet gives some additional awards, such as: Best Thumbnail Ideas, Best Finish Drawing, Best Prototype Model, Best Finish On Car, Best Design, Funkiest Car, Best Overall Car, as well as Fastest Car. I have the students display their cars and drawing and then vote on each of the awards.

Additional Races: If you do this activity with more than one class during the school year, the students enjoy a final race-off at the end of the year. You can take the top finishers from each class or open it to any students that wish to participate. It is best to plan this competition during a time when students have free time, such as lunch or home room, and it usually attracts a crowd of onlookers.

If other schools in your area are doing this same activity, you can have a competition between your classes and those at another school. Also check with the Oregon Technology Education Association for a statewide race car competition.

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS & OBJECTIVES EMPHASIZED:

Each student will:

1. Explore, utilize, and manage the resources necessary for technology (people, tools, and machines, knowledge, capital, materials, energy, and time).

   (Objectives covered in this activity under this goal:)

   a. Demonstrate safe and proper use of tools and equipment.

   b. Explain how the resource limitations of their kit, specifications, and raceway effects their design.

2. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal:)

   a. Apply the problem-solving process to the design and production of their car.

   b. Evaluate the performance of their car by measuring aerodynamic drag, inertia, wheel alignment, and speed, and compare results with other students' performance.

3. Explore and develop understanding of the systems of technology, how systems are controlled, and how systems are used to solve problems.

   (Objectives covered in this activity under this goal:)

   a. Identify the parts that make up the subsystems of their car: engine steering or suspension.

   b. Identify five subsystems of a real automobile.

4. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   (Objectives covered in this activity under this goal:)

   a. Discuss the effects of aerodynamics and weigh have on the efficiency of an automobile.

   b. List other factors a designer must take into consideration when designing a car.

EVALUATION: Based upon instructor observation and evaluation of the student's application of the design process, quality of drawings, prototype model, finished car, craftsmanship, following directions, safety, accuracy of testing data, participation in class discussion.

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	Identification of the subsystems of their car.
2. Mathematics concepts	Use of metric measurement in length and weight. Calculation of performance values of drag, wheel alignment, inertia.
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	Average speed and maximum velocity. Societal implications.
4. Awareness of human elements of technology-societal implications	
5. Communications skills	Use of drawings to communicate design ideas.
6. Safety and health	Demonstrate safe use of tools and equipment.
7. Psychomotor skills	
8. Career-related information	Explore the processes used by an automobile designer.
9. Creative problem solving	Apply problem-solving steps of problem identification, identification of resources and limitations, development of solution modeling, production, and evaluation.
10. Transfer of learning	

RESOURCES:

Contact Person: John Granger
Warrenton High School
(503) 861-3317

REFERENCE BOOKS AND CATALOGS:

Pitsco
PO Box 1328
Pittsburg, KS 66762
1-800-835-0686

Supplier: Instruction booklets, kits, parts, supplies, and racetracks

(ACTIVITY TITLE)

RUBBER BAND VEHICLE

Description of Activity:

In this activity, students will work in teams of two or three to design and build a vehicle that is powered only by a rubber band. The emphasis of the activity is on the problem solving process, not on the finished product.

Time Needed For This Activity: 4-5 Classroom Hours

Occupational Areas:

Construction	Manufacturing
Communication	**Transportation
Power & Energy	

Equipment and Supplies Necessary For This Activity:

Suggested kit parts can vary:
- Wood - 1/4" x 3" x 5" (1)
  3/4" x 6" (1)
- Dowel 1/4" x 4" (2)
- Tacks (4)
- Rubber bands (3)
- String 12"
- Tape
- Zip-lock bag

Procedure: The problem-solving method is essentially the same for each activity.

1. The problem is presented to the students and limitations to the solution are discussed.

2. Students study the problem and possible solutions are suggested. This activity can be done as a group or in small teams.

3. Students choose a solution that they feel is the best to develop, and divide into teams of two or three members. The team then designs and builds their solution. Each team keeps a daily record of materials, tools, and machines used to determine cost effectiveness.

4. The solutions are tested and modifications are done to improve its performance.

5. The team then demonstrates their vehicle.

Activity Description: In this activity students must design and construct a rubber band powered vehicle that will travel at least six feet.

Limitations:

1. The rubber band must be part of the vehicle (no slingshots, etc.).
2. Each member of the team must demonstrate the vehicle operation.
3. The vehicle must start from a dead start (not thrown, etc.).

Resources: Students may use any material, tool, or machine needed to construct the object for cost.

PEOPLE: YOU WILL BE GIVEN A GRANT (MONEY) TO PURCHASE RESOURCES:

- INDIVIDUAL = $65
- GROUP OF 2 = $75
- GROUP OF 3 = $85

YOU WILL SPEND THE GRANT MONEY TO CONSTRUCT YOUR PROJECT.

Tools and Equipment: Hand tools = $2 per class period
Machines = $5 per class period

Materials: Starter kit = $20
Misc parts = 10 x actual cost

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   (Objectives covered in this activity under this goal):

   a. Demonstrate safe and proper use of tools and equipment.

   b. Explain how resources available limit design.

   c. Explain how people can solve problems together.

2. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Apply problem-solving to design and produce race car.

   b. Test and evaluate car for performance, measure drag, inertia, alignment, and speed, and compare to class scores.

3. Explore and develop understanding of the systems of technology, how systems are controlled, and how systems are used to solve problems.

   (Objectives covered in this activity under this goal):

   a. Identify parts of cars and power systems.

   b. Identify systems of design, production, and testing used to evaluate performance.

4. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   (Objectives covered in this activity under this goal):

   a. Write or discuss the effects of design factors on the efficiency of the vehicle.

   b. Describe or list any other factors to consider in designing a car (power, bearings, weight, etc.).

(ACTIVITY TITLE)

BALLOON POWERED VEHICLE

Description of Activity:

In this activity, students will work in teams of two or three to construct a vehicle that is powered only by a single balloon. The emphasis of the activity is placed upon the problem-solving process, not the finished product.

Time Needed For This Activity: 4-5 Classroom Hours

Occupational Areas: (circle one)

Construction	Manufacturing
Communication	**Transportation
Power & Energy	

Equipment & Supplies Necessary For This Activity:

Suggested kit parts can vary:
- Wood - 1/4" x 3" x 5" (1)
  1/4" x 3/4" x 6 (1)
- Plywood - 1/4" x 3" x 6 1/2"
- Dowel 1/4" x 4" (2)
- Tacks (4)
- Balloons (2)
- String - 12"
- Paper clips
- Tape
- Zip-lock bag

Procedure: The problem-solving method is essentially the same for each activity.

1. The problem is presented to the students and limitations to the solution are discussed.

2. Students study the problem and possible solutions are suggested. This activity can be done as a group or in small teams.

3. Students choose a solution that they feel is the best to develop, and divide into teams of two or three members. The team then designs and builds their solution. Each team keeps a daily record of materials, tools, and machines used to determine cost effectiveness.

4. The solutions are tested and modifications are done to improve its performance.

5. The team then demonstrates their vehicle.

Activity Description: In this activity, students must design and construct a balloon powered vehicle that will travel at least six feet.

Limitations:

1. Only one teacher-supplied balloon can power the vehicle.
2. Each member of the team must demonstrate the vehicle operation.
3. The vehicle must start from a dead start (not thrown, etc.).

Resources: Students may use any material, tool, or machine needed to construct the object for cost.

PEOPLE: YOU WILL BE GIVEN A GRANT (MONEY) TO PURCHASE RESOURCES FROM SCHOOL FUNDS OR A FUNDRAISING EVENT.

- INDIVIDUAL = $65
- GROUP OF 2 = $75
- GROUP OF 3 = $85

YOU WILL SPEND THE GRANT MONEY TO CONSTRUCT YOUR PROJECT.

Tools and Equipment: Hand tools = $2 per class period
Machines = $5 per class period

Materials: Starter kit = $20
Misc parts = 10 x actual cost

Evaluation: Solutions will be graded by using the following formula to determine the cost effectiveness:

Average distance/total cost

Other factors considered are: participation in team effort, best construction, creativity, maximum distance.

EVALUATION: Observation of student participation, completion of activity, quality of solution

INTERDISCIPLINE AREAS:	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	Measurement of distances, computing cost effectiveness.
2. Mathematics concepts	Storage of energy, levers, transfer of energy.
3. Science concepts	
4. Awareness of human elements of technology-societal implications	
5. Communications skills	Teamwork mechanics.
6. Safety and health	
7. Psychomotor skills	Team training to operate vehicle.
8. Career-related information	
9. Creative problem-solving	
10. Transfer of learning	

RESOURCES:

Contact Person: Larry Wilson
Gregory Heights Middle School
Portland Public Schools
280-5600

REFERENCE BOOKS AND CATALOGS:

Introduction to Technology
New York State

(ACTIVITY TITLE)

MARSHMALLOW THROWER

Description of Activity:

In this activity, students will work in teams of two or three students to construct a device that will throw a mini-marshmellow over an 18" high wall, five feet away. Solutions may also be tested for accuracy, height, and/or distance of throw.

Time Needed For This Activity: 4-5 Classroom Hours

Occupational Areas:

Construction	Manufacturing
Communication	**Transportation
Power & Energy	

Equipment and Supplies Necessary For This Activity:

Suggested kit parts can vary:
- Wood - 3/4" x 3" x 5" (1)
- 1/4" x 3/4" x 10" (1)
- Plywood - 1/4" x 3" x 6"
- Tacks (4)
- Rubber bands (2)
- Paper clips (2)
- String - 12"
- Tape
- Zip-lock bag

Procedure: The problem-solving method is essentially the same for each activity.

1. The problem is presented to the students and limitations to the solution are discussed.

2. Students study the problem and possible solutions are suggested. This activity can be done as a group or in small teams.

3. Students choose a solution that they feel is the best to develop, and divide into teams of two or three members. The team then designs and builds their solution. Each team keeps a daily record of materials, tools, and machines used to determine cost effectiveness.

4. The solutions are tested and modifications are done to improve its performance.

5. The team then demonstrates their vehicle.

Activity Description: In this activity, students must design and construct a device that will throw a mini-marshmellow over an 18" high wall, five feet away.

Limitations:

1. The device must incorporate a lever in its operation.
2. It must sit flat on the table to operate (cannot be thrown, etc.).
3. Each member of the team must demonstrate its operation.

Resources: Students may use any material, tool, or machine needed to construct the object for cost.

PEOPLE: YOU WILL BE GIVEN A GRANT (MONEY) TO PURCHASE RESOURCES FROM THE BANKING SYSTEM SET UP WITHIN THE SCHOOL.

- INDIVIDUAL - $65
- GROUP OF 2 - $75
- GROUP OF 3 - $85

YOU WILL SPEND THE GRANT MONEY TO CONSTRUCT YOUR PROJECT.

Tools and Equipment: Hand tools = $2 per class period
Machines = $5 per class period

Materials: Starter kit = $20
Misc parts = 10 x actual cost

Evaluation: Solutions will be graded on participation in team, effort, best construction, creativity, maximum distance, height, accuracy, cost effectiveness.

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   (Objectives covered in this activity under this goal):

   a. Demonstrate safe and proper use of tools and equipment.

   b. Explain how the resources available limited design.

   c. Explain how people can solve problems together.

2. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Apply problem-solving techniques.

   b. Apply design and drawing techniques.

   c. Test and evaluate performance.

3. Explore and develop understanding of the systems of technology, how systems are controlled, and how systems are used to solve problems.

   (Objectives covered in this activity under this goal):

   a. Identify car part systems.

   b. Identify systems of design, production, and testing.

4. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   (Objectives covered in this activity under this goal):

   a. Discuss results and design implications.

   b. Discuss impacts of transportation types and systems on society and environment.

EVALUATION: Observation of student participation, completion of activity, quality of solution

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INTERDISCIPLINE AREAS	LEARNING CONSTANTS FOR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	Measurement of distance, computing cost effectiveness.
3. Science concepts	Storage of energy, levers, transfer of energy.
4. Awareness of human elements of technology-societal implications	
5. Communications skills	Teamwork mechanics.
6. Safety and health	
7. Psychomotor skills	Team training to operate vehicle.
8. Career-related information	
9. Creative problem-solving	
10. Transfer of learning	

RESOURCES:

Contact Person: Larry Wilson
Gregory Heights Middle School
Portland Public Schools
280-5600

BOAT HULL DESIGN & TESTING

By: Gary Bolyard
Stanley Komacek

System: Transportation

Unit Title: Marine Transportation
(Technical Systems/Future/Impacts)

Suggested Teaching Time: 7-10 days

Activity Description: Design, produce, and test a marine boat hull that will:

1. Travel faster than any other student-designed boat hull without a payload.
2. Hold the heaviest payload without capsizing.
3. Travel faster than any other student-designed boat hull with a standard payload.
4. Deliver the greatest net profit in simulated payload-to-power tradeoff races.

General Learning Outcomes: GT-1, GT-2, GT-3, GT-7, and GT-8

System Learning Outcomes: TR-1, TR-4, TR-8, and TRO-10

System Building Objectives: 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38

TARGET* Activities
*Teaching Activities & Resource Guide for
Educators of Technology
West Virginia Department of Education
1987

Tools/Equipment/Materials:

Hydrotest rank (see Appendix A)
Weighing acales (postal or metric)
Plate washers for payload and propulsion system
Drafting tools
Bandsaw
Router with straight bit
Rasps/files
Exacto carving set
Stopwatch

Supplies:

Drafting paper
Abrasive paper
Finishing materials
Small screw eyes
2" x 4" x 12" wood block (pine or balsa)
Data recording sheets
Resorcinol glue

Special Resources/Suppliers:

Pitsco, Inc. - Screw eyes, stopwatch, balsa, glue,
Box 1328 drawing paper, etc.
Pittsburg, KS 66762
1-800-835-0686

Time in Days	Teacher	Student
Day 1	Introduce basic discussion on marine transportation: history and the development of moving people/goods on water. Discuss reading on marine transportation from text or resources in technology: differentiate between maritime and inland waterways, identify the importance of and advantages/disadvantages of marine transportation to the local economy and jobs.	Listen, discuss, and take notes.

Day 2	Introduce the concepts of buoyancy, stability, center of gravity, and specific gravity of materials used and various boat hulls by placing various hull designs in the test tank. Describe different boat hull designs used for boats, ships, barges, etc. Identify the basic parts of a ship. Discuss what makes a hull design efficient: skin friction, wave making, eddy making, and air resistance.	
Day 3-6	Introduce the activity and pass out problem sheet.	Sketch possible hull designs. Select "best" design and transfer to wood block. Use bandsaw, router, rasps, files, and abrasive paper to shape the hull. Apply a water resistant finish. Attach a screweye to the bow. Test hull design buoyancy and stability. Add ballast if needed for stability. Weigh finished hull to determine gross tonnage (GT).
Day 7	Make sure all hulls are the same weight.	Add weight (washers) to hull so that all hulls are the same weight ("class standard weight"). Scuttle hull to determine maximum payload by adding weight to hull to determine Dead Weight Tonnage (DWT). Record results on Data Recording Sheet.
Day 8	Test hulls in hydrotank (with "class standard" power supply) and time hulls with stopwatch. Determine most efficient hull speed without payload, and speed, with student-determined safe payload weight.	Compete in competition and record information on chart for: (ETT) empty travel time, (LTT) loaded travel time, with student determined safe payload weight and power unit weight. Record data on chart.

Day 9	Discuss load carrying capacities and the importance of lightweight hulls that can carry a heavy load (cargo) weight.	Calculate load carrying capacity as a percentage of cargo payload-to-hull weight: $\frac{(GT)}{(DWT)}$
Day 10	Relate boat weight and payload carried to real-life situations. Ask students to "buy" more power (weight-pulling hull) with some of their payload to get the maximum payload for the least cost.	Experiment to determine maximum payload-to-power costs ratio. Determine the number of round trips your hull could make in a 40-hour week. Calculate net profit or net loss using chart and formula at bottom of data recording sheet.
	Ask students how their boat hull designs could be improved.	Brainstorm possible improvements to the hull designs.

Background Information:

Cargo carrying boat hulls must be designed to be hydrodynamically efficient in order to be economically efficient to the company which operates the vessel. Design tradeoffs are made based upon the designer's consideration of the type of cargo to be transported, the need for fast speed of delivery, and the nature of the waterway, as well as other variables.

Two Basic Types of Boat Hulls:

- Displacement Hulls - Displace a volume of water equal to the mass of the craft and are designed to plow through the water as efficiently and effortlessly as possible. A side view of a displacement hull would show a rocker-shaped bottom.

- Planing Hulls - Have flat bottoms and ride higher in the water than displacement hulls and, therefore, encounter less drag. The planing hull has less draft and, as speed increases, it will tend to lift toward the surface and ride almost on top of the water.

Basic hull shapes include:

Flat Bottom

Vee Bottom

Round Bottom

Cathedral

Gull-Wing

Multiple Hulls

Hulls are rated with three measures:

- Gross Tonnage (GT) - is a measure of the mass of the vessel itself.
- Net Tonnage (NT) - is a measure of the ship's cargo capacity (a measure of cubic space available).
- Dead Weight Tonnage (DWT) - is the total number of tons of cargo, stores, and bunker fuel a ship can carry.

Boat hulls meet four types of resistance as they move through the water:

- Skin Friction - The drag of the water on the surface of the ship hull. Generally one of the largest factors of the total resistance. Water tends to "stick" to the sides of a moving hull and to be "dragged" along with it. A smooth hull is necessary for efficient boat propulsion. Hull skin friction is highest at the bow and becomes progressively less toward the stern.

To reduce skin friction:

- Make sure hull is smooth and polished.
- Keep the "wetted surface" area of the hull to a minimum.
- Avoid hull projections.

Because skin friction is reduced proportionately as it is further aft from the bow, a longer boat has advantages over a shorter one.

Wavemaking Resistance - Occurs as a result of the energy required to set up the system of waves around the hull as the vessel moves through the water. The bow (front end) must part the water in front of the boat. An amount of water which is equal to the mass of the hull is displaced during this separation, which causes a wave of water to push back against the hull.

Two things cannot occupy the same space at the same time. As a hull moves forward it preempts space that an instant before had been occupied by water. The water is pushed away in two directions, out and down. As the hull vacates the space, the water rushes back to fill the void, forming two kinds of waves:

- Bow waves - waves moving diagonally away from the boat.
- Stern waves - the side waves eventually combine with a disturbance caused at the stern. (How smoothly this recombination is effected has a great bearing on the total performance of the hull.) (see Figure 1).

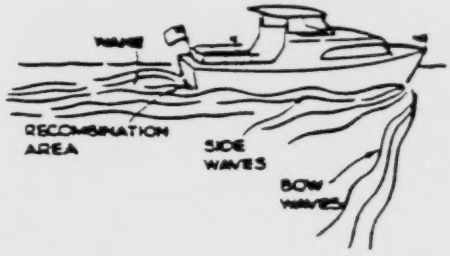


Figure 1

Eddy Making - Causes resistance at the stern (rear) of the boat. After the bow parts the water and the boat moves forward, the water rushes back in behind the boat causing swirling eddies against the stern. These eddies create a backward drag on the hull.

The tendency to eddy making is highly influenced by the size and shape of the stern. The best, most efficient type of stern is the double-ender, as opposed to a square transom stern.

Figure 2

Air Resistance - The resistance offered by the air as the ship moves which varies with conditions. It is usually not a major factor.

The ideal cargo carrying boat hull design (in economic terms) would have:

- the greatest possible DWT capacity
- hydrodynamically designed (to reduce skin friction, wavemaking, eddy making, and air resistance)
- would permit the easiest and fastest motion, with the least amount of energy expended

The geometry of a ship is usually delineated on the "lines drawing", which consists of three plans or views:

- Elevation or profile of the ship - a view looking down upon the vessel. Since the ship is symmetrical a "half-breadth plan" is usually drawn showing one-half of the total ship (see Figure 3a).

- The "shear" view - a side view showing basic hull shape, height above water, its freeboard, etc. (see Figure 3b).

- The "body" view - includes one view going from bow to amidships, and another from amidships to the stern, usually combined on a center line (see Figure 3c and d).

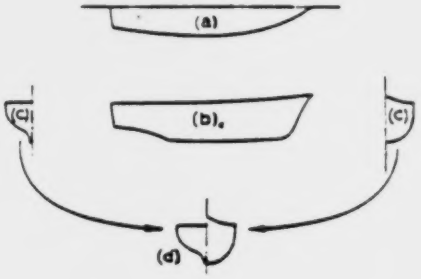


Figure 3

Three important characteristics of hull design are:

- Buoyancy - The power if a fluid to bear up a body that is in it. An object in a fluid is pushed up, or "buoyed", by a force exactly equal to the weight of the displaced fluid.

  All fluids have this power to a greater or lesser degree depending upon how dense they are. (Sea water supports more weight per volume than fresh water, due to the salt.)

  In the sketch below, the water which previously had filled the space occupied by the liner's hull weighs exactly as much as the ship. The upward pressure of the surrounding water (the buoyancy) is therefore sufficient to sustain the ship; therefore, it floats (see Figure 4).

The "center of buoyancy" is an imaginary point at the center of the "hollow" left by the liner below, which is symmetrical to the entire volume. This point is the center of buoyancy.

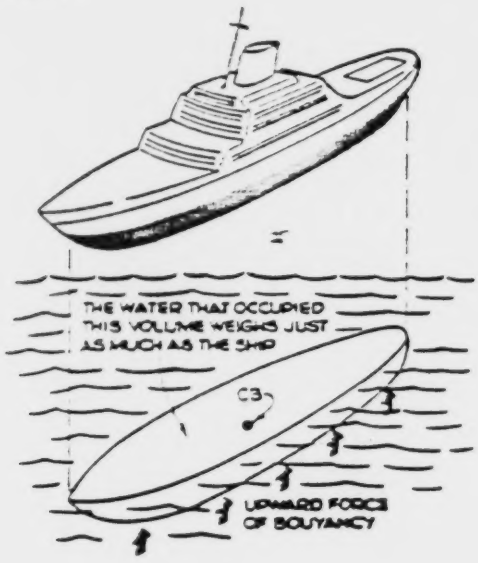


Figure 4

- Stability - For a vessel to be stable, it must be able to stay right side up under all reasonable conditions. There are three conditions of stability: stable, unstable, and neutral (see Figure 5).

  It is a law of nature that a body which is in an unstable position will tend to gain stability by moving to a stable position.

  Certain forces, such as gravity, must work in order to move such an object.

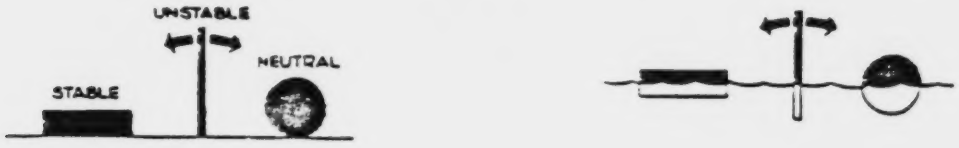


Figure 5

- Center of Gravity - A point in any object that can be considered the focus of gravitational pull. The force of gravity is always down.

* When two forces are acting in opposite directions, they form a "force couple". The resultant of a couple whose forces are not in a straight line is a torque or twisting motion. Buoyancy and gravity are two equal forces acting in opposite directions; therefore, they form a force couple. Such a couple is beneficial if it tends to right a heeled hull, but can be extremely dangerous if it tends to upset the hull (see Figure 6).

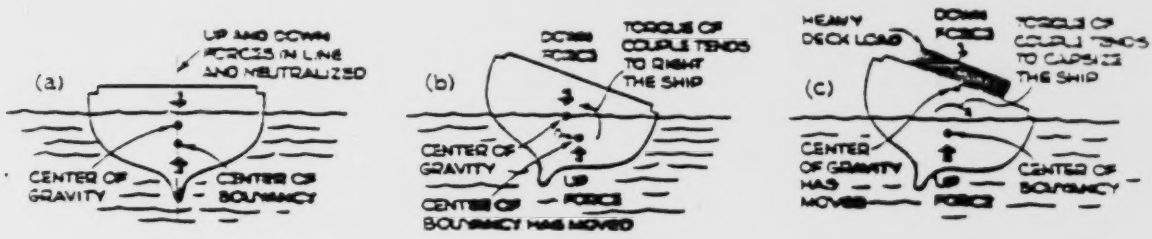


Figure 6

* The center of gravity in a ship should always be low. Lowering of the center of gravity can be done by adding weight in the bilge directly over the keel. This weight is called "ballast". The most desirable ballast is lead due to the fact that it has the highest specific gravity (of economically available metals) and that it can be poured into place in the hull.

* Displacement hulls display a direct relationship between their overall length and their economical top speed, as expressed by the formula:

$$\frac{V}{\sqrt{L}} = \text{Max, economical Speed in knots}$$

Where: V = Speed in knots
L = Effective waterline length of ship

As the speed-length ratio increases, the resistance of the ship also increases. In order to obtain an efficient hull form, from a resistance standpoint, a suitable length must be selected for minimum resistance.

Six Basic Types of Cargo Ships:

- General Cargo or Break-Bulk Ships - usually have two or three levels or "decks" and four or five "holds" (large cargo storage areas). Most of these ships have their own cranes for loading and unloading cargo.

- Tankers - special type of ships designed to haul liquid cargo.

- Supertankers - are used to transport large amounts of crude oil. These ships are among the largest in the world.

- Containerships - are ships which are especially designed to carry containers. Their main advantage is that they can be loaded and unloaded quickly.

- Barge Ships - are used to carry large barges across the ocean. Two basic types are Lash and Sea Bee.

- Cruise Ships - large passenger transport vessels, which are used for sea cruises or ocean crossings.

Basic Marine Transportation Terminology:

- Barge - A blunt-ended, scow-type craft, usually nonself-propelled, used to haul supplies or garbage.

- Beam - The extreme breadth of a ship or boat.

- Bow - The forward end of a ship or boat.

- Bow Wave - The first water displaced as the marine vessel moves through the water.

- Deck - Horizontal planking or plating which divides a ship into layers.

- Displacement - The volume or weight of a fluid (such as water) displaced by a floating body (such as a ship) of equal weight.

- Draft - The depth of the lowest part of the ship below the waterline.

- Freeboard - The amount the ship projects above the waterline to certain specified decks.

- Fluid Dynamics - The resistance of a medium (water) to a body moving through it.

- Gunwale - Where top, sides, and deck meet on a vessel.

- Keel - The lowest part of the ship. It runs the length of a ship and provides the ship with its strength. It could be compared to the backbone of a human being.

- Pitch - When the bow rises and falls as if rotating on an axis passing through the beam of a vessel.

- Port - To the left of the center line when facing forward.

- Primsoll Marks - A symbol on the side of the ship that shows when a ship is fully loaded (when the water reaches the symbol).

- Righting Moment - A force that tends to restore a naval vessel to its upright position after it has been moved or tipped by wind or waves.

- Roll - Transverse angular rotation about a horizontal force and aft axis.

- Rudder - Device attached to a ship's stern which controls the ship's direction of travel.

- Scuttle - The act of deliberately sinking a vessel.

- Starboard - Direction to the right of the center line as one faces forward.

- Stern - The rear of a vessel.

- Stern Wave - Water rejoining/attempting to go back to its original location or level.
- Transom - The flat, vertical aft end of a ship or boat as distinguished from a canoe-shaped or cruiser stern.

- Wake - Trail left by a vessel, or other object, moving through the water.

- Yaw - The sidewise movement of vessel in the water as if steering were ineffective.

REFERENCES:

DeOld, Sheets, Alexander (1986), Transportation: The Technology of Moving People and Products, Worcester, Massachusetts: Davis Publications, Inc.

Bohn, MacDonald, Fales, Kuetemeyer (1986), Energy, Power, and Transportation Technology, Peoria, Illinois: Bennett & McKnight Publishing Co.

DeVore, Paul W (Ed.) (1983), Introduction to Transportation, Worcester, Massachusetts: Davis Publications, Inc.

Zadig, Ernest A (1972), The Complete Book of Boating, Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Bolyard, Gary M (1987), WV Technology Education Program Guide: Transportation, Charleston, West Virginia: State Department of Education.

General Industrial Arts Competency-Based Curriculum in Transportation, Nashville, Tennessee: State Department of Education.

McGraw-Hill Encyclopedia of Science & Technology, 5th Edition, No. 12, New York, New York: McGraw-Hill Book Company, 1982.

Center for Implementing Technology Education (CITE), Technology Activities, Vol. I, No. 4, 1986, Muncie, Indiana: Ball State University.

Buckley, W F, and Buckley, C, "The New Man and The Sea", Popular Mechanics, July, 1986.

Energy Efficiency of Sea and Air Vehicles, Superintendent of Documents, U.S. Government Printing Office, Washington, DC, 20402, 1978. (S/N 050-12-00149-9)

DESIGNING & TESTING EFFICIENT BOAT HULLS
Design Problem & Test Procedures

Name:_____ Date:_____

Class:_____

Problem: Design and manufacture a boat hull which will:

1. hold the heaviest dead weight tonnage (DWT) cargo payload without capsizing; and

2. deliver the greatest net profit in a simulated payload-to-power tradeoff test.

Design Criteria and Parameters:

1. The hull is to be designed and built from a piece of 2" x 4" x 12" section of pine or balsa.

2. The hull should be designed with two criteria in mind:

   a. maximum dead weight tonnage (DWT) capacities
   b. maximum profitability based on payload-to-power tests

3. Each hull is to be designed and built by an individual.

4. The top surface (deck) of the hull should remain flat to carry a payload of washers. The deck may be recessed for stability.

5. A full-size three-view sketch of the hull design must be made (elevation, shear, and body).

6. The full-size drawings are to be used as cutting templates during the construction of the hull.

7. Any finishing method may be used.

8. A screweye must be installed in the bow of the hull.

Hull Evaluation:

During the performance tests for the hull, record all necessary data on the "Testing Boat Hulls Data Recording Sheet".

Testing Procedures

Gathering Base Data:

1. Weigh your finished hull to determine GROSS TONNAGE (GT). Record the data.

2. Scuttle your hull by loading it with weights (washers) until it capsizes or sinks. This activity establishes the maximum cargo payload or DEAD WEIGHT TONNAGE (DWT).

3. Compute cargo PAYLOAD-TO-HULL WEIGHT RATIO. The figure is a percentage and is calculated by dividing the hull weight (GT) by the cargo payload weight (DWT).

4. Attach your empty hull to the line on the hull pulling mechanism. Allow the weight, which is part of the pulling mechanism, to pull the hull through the water. Use a stopwatch or clock with a second hand to time the travel. This is the EMPTY TRAVEL TIME (ETT). Record the data on the chart.

Gathering Economic Payoff Data:

This test will simulate real-world economic payoffs in water transportation. The goal is to realize the maximum profit by transporting the heaviest load, with the least amount of fuel (power), while maintaining a reasonable time schedule (people on a ship add costs each day the trip takes).

This test will "pay" you for the payload delivered and will "cost" you for the units of power used. The difference between these items will equal the"profit" for the trip.

5. Determine the SAFE PAYLOAD WEIGHT and the POWER UNITS WEIGHT that you will use for the test.

6. Load the hull and measure the LOADED TRAVEL TIME (delivery) for your hull in the tank.

7. Add the EMPTY TRAVEL TIME (return) found in Step 4 of the first test to the results of this test. This will give you the round trip time for the journey. This assumes that you carried cargo in one direction and returned empty to your home port.

8. Determine the number of ROUND TRIPS your hull could make in a 40-hour week. (Remember, 40 hours = 2,400 minutes which = 144,000 seconds.) Divide your round trip time in seconds into 144,000. Drop any fraction of a trip.

9. Determine NET PROFIT or NET LOSS for your boat hull. To do this, fill in the chart at the bottom of the DATE RECORDING SHEET. Enter the data into the formula and solve for PROFIT or LOSS. A positive number is a profit and a negative number is a loss.

TESTING BOAT HULLS Name: _____

Data Recording Sheet Date: _____

Step	Test		Findings
1	Gross Tonnage (weight of hull)	GT	_____ grams
2	Ballast (equalizing weight)	B	_____ grams
3	Time: With Class Standard Weight	CST	_____ sec.
4	Dead Weight Tonnage (maximum cargo cap.)	DWT	_____ grams
5	Payload-to-Hull Weight Ratio	$\frac{GT}{DWT}$	_____ %
6	Safe Payload Weight (student determined)	SPW	_____ grams
7	Power Unit Weight (student determined)	PUW	_____ grams
8	Loaded Travel Time (DELIVERY with #6 and 7)	LTT	_____ sec.
9	Empty Travel Time (RETURN)	ETT	_____ sec.
10	Round Trip Travel Time (ETT + LTT)	RTT	_____ sec.
11	40-Hour Week Round Trips ($\frac{144,000 \text{ sec.}}{RTT}$)		_____
12	Net PROFIT or Net LOSS		_____

	40-Hour Week Round Trip	Cargo Delivered Per Trip (Grams)	Pay for Cargo * $	Power Units Used grams	Power Units Costs * $
Delivery	(A)	(B)	(C)	(D)	(E)
Return	(F)			(G)	(H)

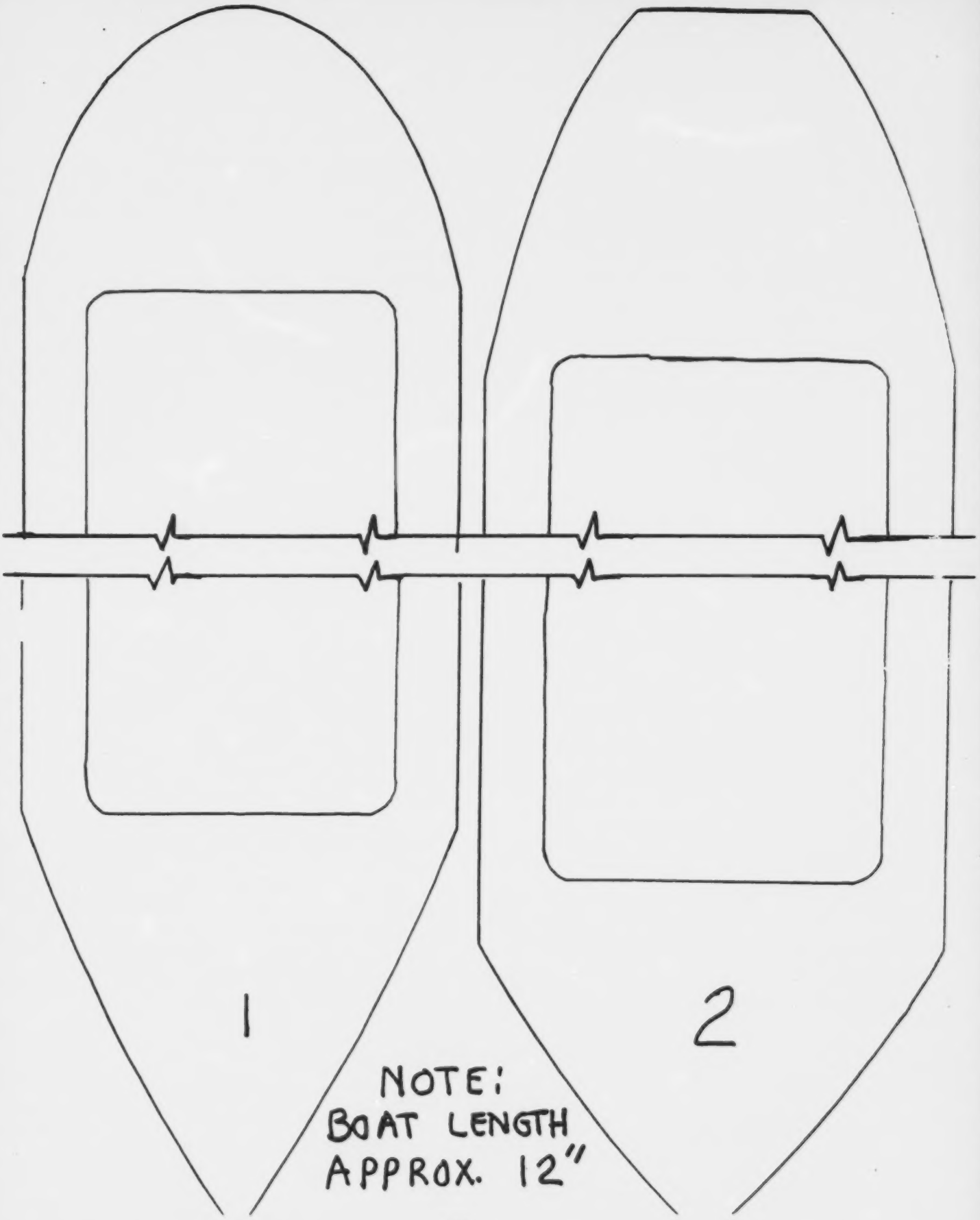
Profit (+) or Loss (-) Formula

$$P/L = (A)\ (B \times C) - [(A)\ (D \times E)] + [(F)\ (G \times H)]$$

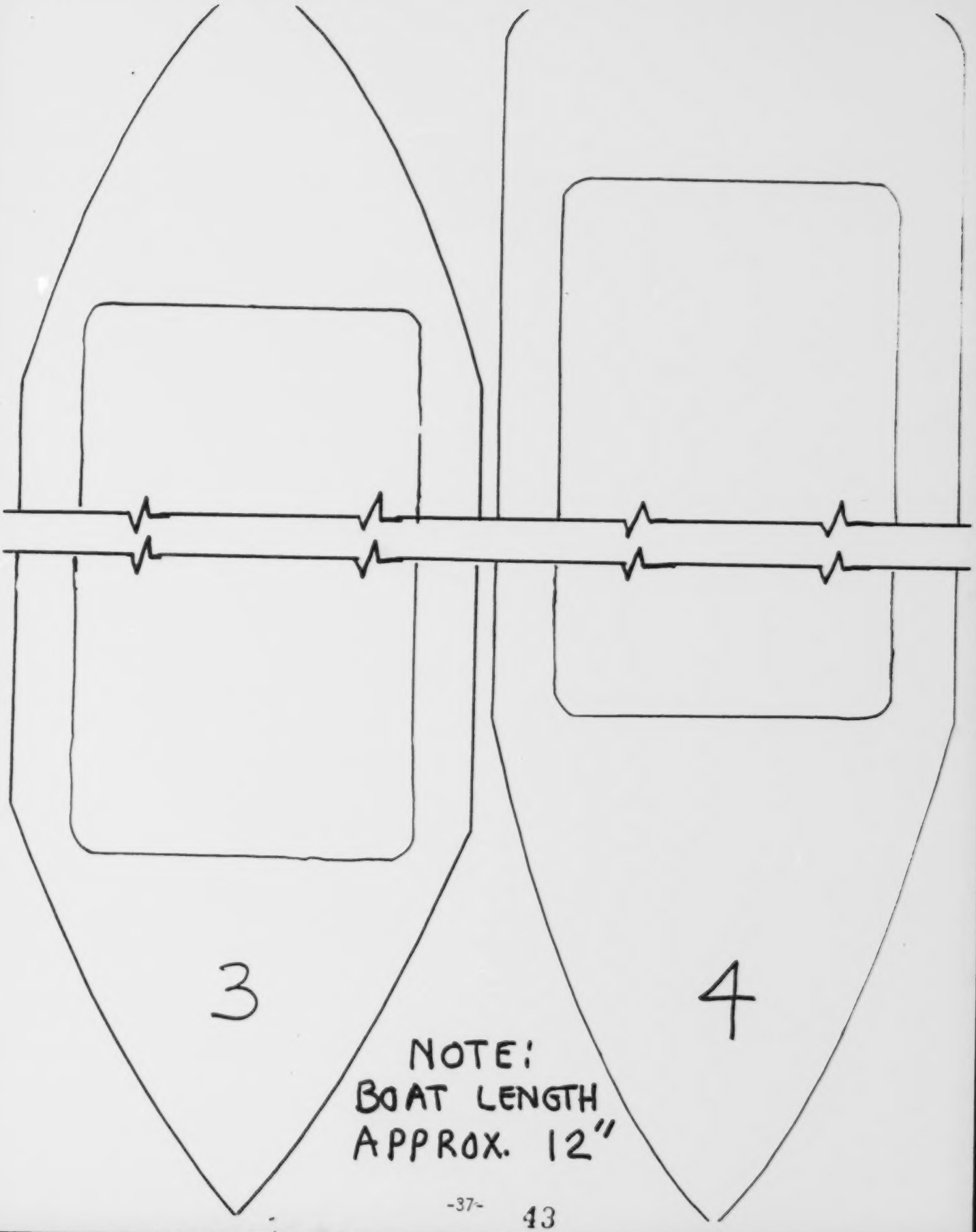
PROFIT/LOSS = INCOME - POWER COST DELIVERY + POWER COST RETURN

TOTAL COST FOR A ROUND TRIP

* (C) above is "teacher determined" (example: $25 per unit).
* (E) above is "teacher determined" (example: $15 per unit).



NOTE:
BOAT LENGTH
APPROX. 12"

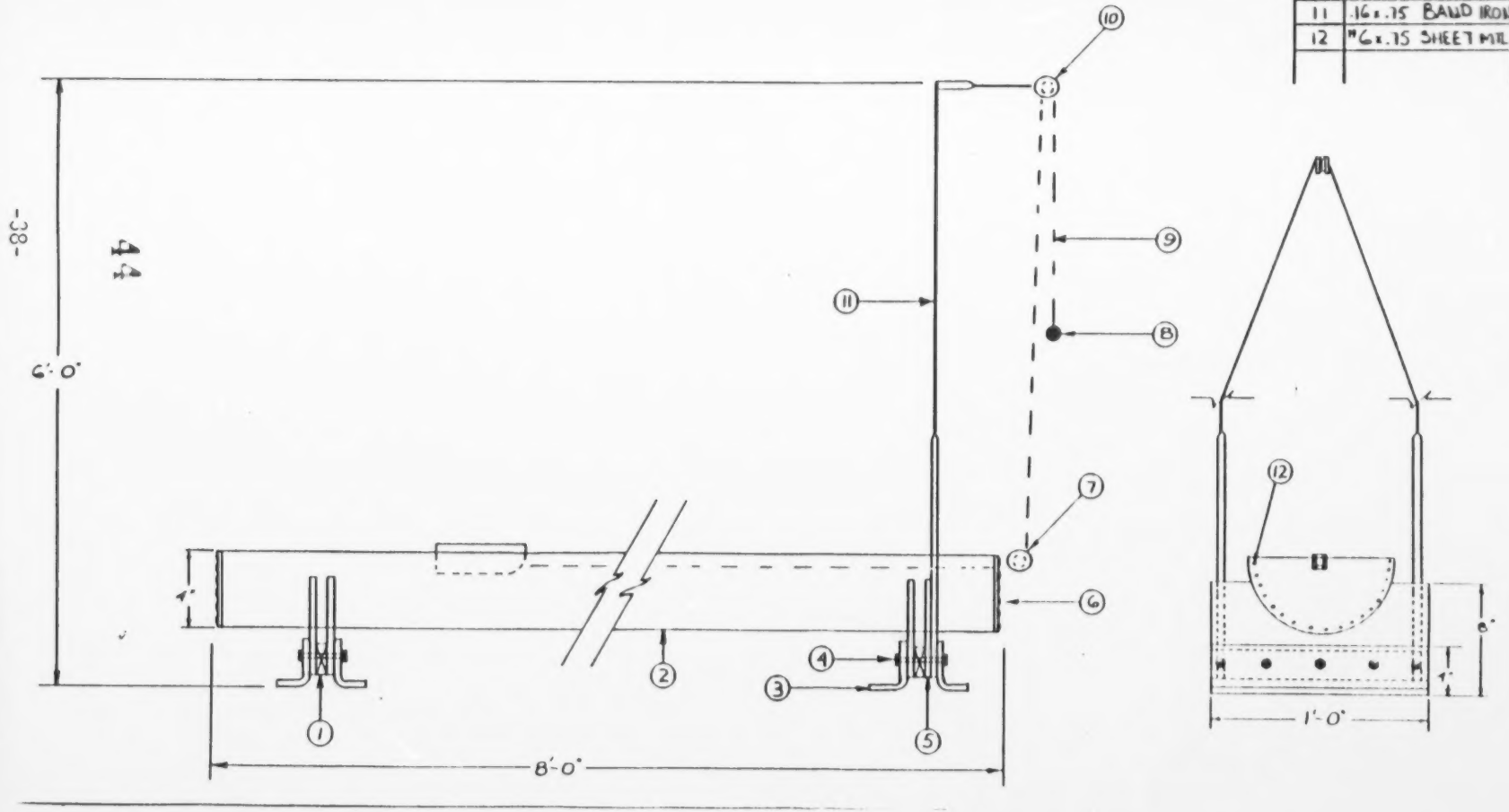


NOTE:
BOAT LENGTH
APPROX. 12"

MARINE TRANSPORTATION

HYDRO-TANK

1	2x4x12	PINE	2
2	8" DRAIN PIPE	PVC	1
3	.25" PLEXI-GLASS		4
4	.25" x 3.5"		10
5	.25 PLEXI-GLASS		4
6	.25 PLEXI-GLASS		2
7	FIXED PULLEY		1
8	LEAD WEIGHT		1
9	20lb FISH LINE		1
10	EYELET PULLEY		1
11	.16x.15 BAND IRON	STEEL	1
12	"6x.15 SHEET MTL.		12



SECTION 2

COMMUNICATION ACTIVITIES (TLA)

INDUSTRIAL ARTS/TECHNOLOGY LEARNING ACTIVITY

USING "CADDRAW" TO INTRODUCE COMPUTER-AIDED DRAFTING

Description of Activity:

This activity gives students an opportunity to explore computer-aided drafting through the use of the "CADDRAW" software package. The student is presented with a prototype of a product and given the assignment to produce a working, multiview drawing of the product using the computer. The student is given a step-by-step written procedure to guide him through the drawing, saving, and printing of his drawing. This activity can give students a low-cost introduction to the vocabulary and function of a CAD station.

Time Needed For This Activity: 1-2 Classroom Hours

Occupational Areas: Communication

Equipment and Supplies Necessary for This Activity:

The CADDRAW System: This system requires three pieces of software in order to draw, save, and print your drawing. They can be purchased as a package.

CADDRAW 4.0
The SYMBOL MAKER/EDITOR
Triple Dump

Apple II+, IIe, or IIc (48K required)
DM Printer

Introduction:

Computers have become valuable drafting tools for many designers, architects, and draftspersons. In many cases, drawings can be produced more efficiently with the help of a computer. Computer technology has automated the drafting process. The boring and time-consuming parts of drafting can be performed by the computer. Changes can be made without redrawing the plans. Lastly, using a computer allows the technologist to spend more time in creative and problem-solving endeavors. The following activity will introduce you to computer-aided drafting.

Problem Statement:

Your student enterprise, Bright Ideas, Inc, has decided to manufacture a device that displays business cards on a desk. Student designers have developed several designs for business card holders. Members of the product engineering department, meaning you, have to specify the design. One major task when specifying the design is to develop working drawings based on the mock-ups. Using the mock-up provided, you are to draft a multiview drawing for the business card holder.

Implementation Hints:

1. To implement this activity, you will need a software package called "CADDRAW". In order to print the drawings, you will also need a program called "Triple-Dump". Both programs will run on any Apple II series computer with at least 48K of memory. The programs do not require special hardware. CADDRAW and Triple-Dump are available through Hearlihy & Company, 714 W Columbia St, Springfield, Ohio 45501, telephone (513) 324-4721.

2. To help students be successful, the problem statement requires students to draft plans for a business card holder based on three dimensional mock-ups. Prior to implementing this learning activity, you could either make the mock-ups yourself or have students make the mock-ups during a design unit. The mock-ups can be made out of cardboard, foamcore, or hardboard.

3. When your students finish their drawings, they will need to be stored on a disk. The drawings should not be stored on the CADDRAW program disk. Therefore, you will need to prepare several file disks. Any blank disk that has been initialized with 3.3 DOS can serve as a file disk.

Procedures:

1. Obtain a program titled "CADDRAW", a program titled "Triple-Dump", and a file disk from your instructor.

2. Make sure the computer is off. The switch is on the back of the computer on the left side. Open the disk drive door. Hold the disk with the label up and closest to you. Insert the disk so the window exposing the Mylar enters first. Gently push the disk in until you hear or feel a click when the disk is in all the way. Close the disk drive door and turn the computer on.

3. The first thing that will appear on the screen is an introductory graphic message announcing the program's name, author, and publisher. The CADDRAW LIBRARY will automatically follow. Setting up the drawing page is your first task. The command for CENTERING/BORDER a drawing is number 11. Type number 11. The program will then ask you to push any key.

   If you choose to use this program for other learning activities, you will want to explore every feature listed in the library. However, for the purposes of this activity, your students only need to learn how to CENTER/BORDER and SAVE a drawing.

4. The next menu allows you to select a page for your drawing. Since we are only making one drawing, you will only need one page. Type number 1.

5. The next menu will display five border options. For this activity, border number 3 is a good choice. Type number 3.

6. The next menu asks you to select the type of drawing you want to draw. Your mock-up requires a standard orthographic projection (top view, front view, and right side view). Therefore, type number 1.

7. The next menu will ask you to enter the basic dimension for the object you want to draw. Your mock-up is basically 3" wide, 2" high, and 1.5" (1½") deep. Enter each dimension and press the return key after each entry.

8. After you have entered the basic dimensions, the program will ask you if you entered them correctly. Check each dimension. If they are correct, press the letter Y. If you made a mistake, press the letter N and enter the dimensions again.

9. The program will now ask you to enter the distance between views. For this activity, 1" will be appropriate. Press the number 1 and push the return key.

10. Lastly, the program will ask how you want to plot the views. Since our mock-up is basically a rectangle, select PLOT VIEW OUTLINES.

11. The program will quickly display the three views on the screen and then it will jump back to the CADDRAW LIBRARY. Do not be alarmed. Do not try to set up a new drawing page. Simply press the ESC (escape) key in the upper left hand corner of the keyboard. This will access the drawing mode.

12. Displayed on the screen are three rectangles, a blinking cursor, and an assortment of information at the bottom of the screen. Before you start drawing, you will need to experiment with a few drawing commands. Don't worry, the only command you really need to remember is the letter C. Push the letter C. The letter C accesses the COMMAND SUMMARY DISPLAY. To return to the drawing mode, push any key.

13. **Moving the Cursor** - The four arrow keys on the bottom right side of the keyboard move the cursor. Try moving the cursor around the screen using each key. You will notice the cursor "jumps" about an inch on the screen with each key stroke. In the lower left corner of the screen you will see JP=&.

    Push the return key. Notice the JP=& is now JP=6. Try moving the cursor around the screen. The cursor now moves with much smaller "jumps" with each key stroke.

    Push the return key again. Notice, JP+6 is now JP+1. Try moving the cursor. Each key stroke moves the cursor one pixel (one tiny dot on the screen) at a time.

    Push the return key one more time. You are now back to JP=&. By using the return key, you can move the cursor anywhere on the drawing page. Using a combination of JP distances moves the cursor back to the middle of the screen.

14. **Measuring on the Screen** - Using the various JP settings, move the cursor to the upper right corner of the front view. In the lower left corner of the screen, the value for the X axis and the Y axis are displayed. Right now, they are of little use to you. Press the letter M. The values for X and Y are now equal to 0. The letter M is the command for MEASUREMENT RESET.

    With JP=&, move the cursor down one jump. The value for X is still 0, but the value for Y is now 1. Therefore, on this drawing, JP=& equals 1 inch movements. Move the cursor back to the upper right corner of the front view.

Using the return key, change JP=& to JP=6. Move the cursor down one jump again. This time, Y equals .25, which makes basic measurements on the screen. The most important thing you need to remember about JP=1 is that it moves the cursor one pixel at a time. This will come in handy when you try to erase a line.

15. **Drawing a Solid Line** - Examine the front view of the mock-up provided. You will notice a line needs to be drawn across the front view to show that the front is lower than the back. With JP=&, move the cursor down one inch from the upper right corner of the front view.

    Notice you have two cursors on the screen, one large cursor and one small cursor. Press the letter P. The letter P is the command for POINT SET. Basically, you have just plotted a point on the drawing page.

    Using an arrow key, move the cursor to the other side of the front view (X=3 and Y=1). You now have two cursors on the screen. Push the space bar (the long narrow key in the center bottom of the keyboard). A line should appear between the two points. The space bar is used to draw.

16. **Drawing Hidden Lines** - In order to show the thickness of the bottom of the business card holder, a hidden line needs to be drawn ¼" from the bottom of the front view. Move the cursor to the lower right corner of the front view (X=3 and Y=2).

    Push the letter M for Measurement Reset (X=0 and Y=0). Set the cursor jump for JP=6. Using the up arrow key, move the cursor to X=0 and Y=.25 (¼"). Press the letter P for POINT SET.

    Push the return key so JP=& and move the cursor to the other side of the front view (X=3 and Y=.25). There should be a cursor on each side of the front view. Do not push the space bar yet. If you push it now, a solid line will be drawn across the front view.

    You need to tell the computer you want a hidden line. Push the letter I. The letter I is the command for drawing HIDDEN lines. Now you can push the space bar. Once the hidden line has been drawn, you change the program back to its solid line mode. Push the letter O. The letter O is the command for drawing SOLID lines.

17. **Erasing Lines** - Move the cursor to the upper left corner of the right side view. Press the letter P to establish a POINT SET. Using JP=&, move the cursor to the upper right corner of the right side view. Push the letter E. You guessed it. The letter E is the command for ERASE.

18. You now know the basic commands needed to finish the multiview drawing. Remember, the only command you really need to remember is the letter C. It accesses the COMMAND SUMMARY DISPLAY. Using the mock-up as a reference, finish the top view and the right side view. If you run into some trouble, refer to the example drawing provided in the back of these materials.

19. **Entering Text** - Once you have finished all three views, you need to letter in "TAKE ONE" across the front view. Press the letter T. The letter T accesses the TEXT MODE.

    Move the text cursor to the middle of the front lip of the business card holder. Using an arrow key, backspace four spaces.

    Push the letter B. The letter B allows you to BEGIN entering text. Type "TAKE ONE". To END a line of text, hold the control key down and press the letter E.

    Pressing the > key will enable you to scroll the screen and display the title block. Repeating the process for entering text, complete the title block. Include information like your name, school, and the date. When you have finished the title block, hold the control key down and press the letter E. To scroll the screen back to normal, press the < key.

20. **Saving a Drawing** - Now that you have finished your drawing, press the ESC (escape) key. This will access the CADDRAW library. As you can see on the display, the command for saving a drawing on page one is 14. Enter 14 and press the return key.

    The program will ask you to remove the CADDRAW disk and insert a file disk in the disk drive. Remember to put the CADDRAW disk back in its envelope. Insert the file disk as instructed and press any key.

    The program will ask you to enter a name for your drawing. Please use your last name to save your drawing. Type your last name and press the return key to save your drawing.

21. **Printing a Drawing** - After you have saved your drawing, remove the file disk and return it to its envelope. Remove the disk labeled TRIPLE-DUMP from its envelope and insert it in the disk drive.

    Using your left hand, hold the control key and the open apple key down (it is on the left side of the space bar and has a hollow picture of an apple on it). With your right hand, press the "reset" button in the upper right corner of the keyboard. This will boot (start up) the TRIPLE-DUMP program.

    This program is a utility program that enables you to print your drawing. Soon after you have booted the disk, an introduction graphic will scroll onto the screen. When the display stops scrolling, press the letter R. The program will continue to load and the TRIPLE-DUMP menu will appear on the screen.

    Remove the TRIPLE-DUMP disk from the disk drive and return it to its envelope. Remove the file disk from its envelope and insert it in the disk drive.

    The main menu will display columns of information. The list on the left side of the screen begins with TYPE: HI-RES PICTURE. Press the return key.

A new menu will appear on the screen. It lists all the files on the file disk. Using the down arrow, move the highlighted area to your drawing's file name and press the return key.

Your drawing should appear on the screen. The TRIPLE-DUMP menu will automatically follow your drawing on the screen.

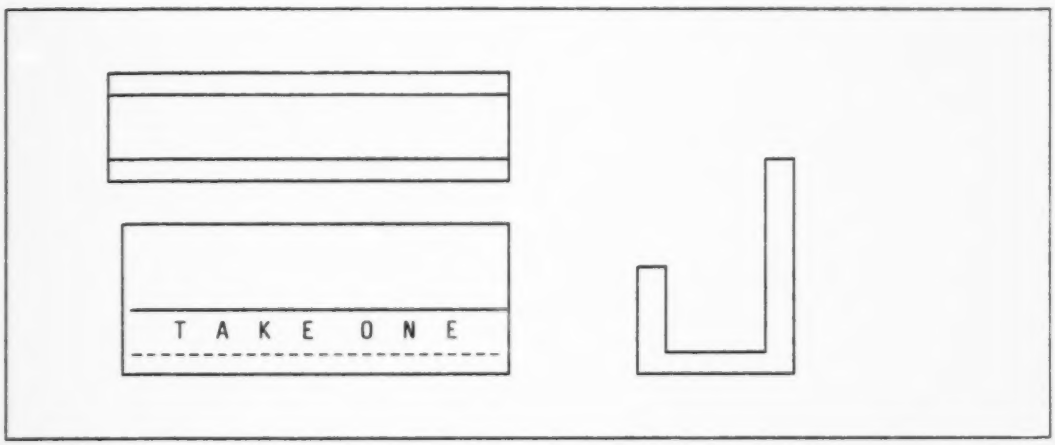
Now that you drawing is in the computer's memory, move the highlighted area to NEGATIVE: NO. Press the return key. It should now read NEGATIVE: YES.

Move the highlighted area to MAGNIFY X: 1. Press the return key, press the number 2, and press return again. The command should now read MAGNIFY X: 2.

Move the highlighted area to MAGNIFY Y: 1. Press the return key, press the number 2, and press return again. The command should now read MAGNIFY Y: 2.

Use the up arrow to move the highlighted area to PRINT PICTURE and press the return key. A new message will appear on the screen and it will ask you to press the return key to print. DO NOT press the return key yet. Make sure the printer is on. Advance the paper so the perforation between two sheets is just above the print head. Now press the return key.

The printer should start printing. When the printer stops, advance the paper and tear off your drawing.



MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS & OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. Report on past drafting and designing techniques and the time it takes to change one dimension on a print done the old way.

2. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   (Objectives covered in this activity under this goal):

   a. Use a computer to produce a full-scale, two-view drawing.

3. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Discuss the ways the computer can be used in designing or other activities.

   b. Apply problem-solving and self-inquiry methods.

4. Explore and develop understanding of the systems of technology, how systems are controlled, and how systems are used to solve problems.

   (Objectives covered in this activity under this goal):

   a. Explore the use and application of computer drafting systems.

5. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   (Objectives covered in this activity under this goal):

   a. Discuss how the application of computer-aided drafting will change the training and qualifications necessary for people working in drafting and engineering.

EVALUATION: Teacher evaluation of student's printed drawing to a ANSI drawing standard, or by student checklist or vote.

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	Use of measurement, decimals, and x-y coordinates.
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	
4. Awareness of human elements of technology-societal implications	Societal implications.
5. Communications skills	Vocabulary development of drafting and computer-aided drafting terms.
6. Safety and health	
7. Psychomotor skills	Manipulation of computer input device: keyboard, mouse, light pen, etc. (whatever is available).
8. Career-related information	Explore the use of the computer in field of drafting.
9. Creative problem solving	
10. Transfer of learning	

RESOURCES:

Contact Person: John Granger
Warrenton High School
(503) 861-3317

REFERENCE BOOKS AND CATALOGS:

Hearlihy & Company
714 W Columbia St
Springfield, OH 45501
(513) 324-5721

The computer CADDRAW System (includes Symbolmaker/Editor and Triple-Dump)
input devices: Gibson light pen, Koala pad, Applemouse, joysticks.
CADDRAW video: instructional video for student use.

(ACTIVITY TITLE)

OPERATION BOARD

Description of Activity:

In this activity, students working alone or in groups select a device, locate a broken or unwanted one, disassemble it to find out how it works, and display their findings.

To display the findings, students make an operation board out of materials of their choice--those commonly found in an industrial arts/technology lab.

Time Needed For This Activity: 3-5 Classroom Hours

Occupational Areas:

Construction
Communication
Power & Energy
Manufacturing
Transportation

Equipment and Supplies Necessary For This Activity:

Devices that can be disassembled (broken or unwanted items)

Introduction:

Many devices have been developed to meet human needs and wants. These devices utilize different technological systems to accomplish their tasks.

Problem Statement:

Discover how a device operates and the different technological systems it uses.

Procedure:

1. Select a device (broken or unwanted)

2. Carefully take the device apart to learn how it works and the different systems involved.

   Systems: cam
   gear
   lever
   chain and sproket
   pulley and belt
   hydraulic
   etc.

3. Display your findings on an Operation Board.

   Possible components: sketches
   information sheets - what it does, how it works, inventor, positive/negative outcomes

4. Find out the date your device was invented and add to a technology timeline kept with the aid of a computer.

5. Present your findings to the class. Be sure to show your Operation Board.

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS & OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. Discuss how or what product may have been made over 20-50 years ago.

2. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   (Objectives covered in this activity under this goal):

   a. Organize the information collected into a display.

3. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Identify communication link to convey message to class or receiver.

   b. Problem-solve order, methods, materials.

4. Explore and develop understanding of the systems of technology, how systems are controlled, and how systems are used to solve problems.

   (Objectives covered in this activity under this goal):

   a. List the systems in a device.

   b. Discover the relationship of systems and subsystems.

5. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   (Objectives covered in this activity under this goal):

   a. Identify the variety of materials in the product.

EVALUATION: 1. Class presentation
2. Accuracy of the display

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	Gears, pulleys, etc.
2. Mathematics concepts	
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	Action/reaction
4. Awareness of human elements of technology-societal implications	Advantages/Disadvantages
5. Communications skills	Writing, organization of information. Use of tools in construction of display.
6. Safety and health	
7. Psychomotor skills	
8. Career-related information	
9. Creative problem solving	Disassembly methods-order of work.
10. Transfer of learning	

RESOURCES:

Contact Person: Tim Taber
Tubman Middle School
280-5630

(ACTIVITY TITLE)

EVOLUTION BOARD

Description of Activity:

In this activity, students working alone or in groups select a device or a process and trace its development. To accomplish this activity students will utilize the library to locate information, organize information, construct an evolution board (wood or cardboard) to display the information, and report their findings to the class.

Time Needed For This Activity: 3-5 Classroom Hours

Occupational Areas:

Construction
Communication
Power & Energy
Manufacturing
Transportation

Introduction:

Over the years, devices and processes have evolved (changed) to keep pace with technology, improve their performance, update time, keep them competitive in the marketplace, or allow them to continue to meet changing human needs and wants.

Problem Statement:

Trace the evolution of a device or process, construct a display showing the evolution, and report your findings to the class.

Procedure:

1. Select a device or process.

2. Research the history and development of the selected item.

   Who invented it?
   When was it invented?
   What are the different stages of development/dates?
   How has it changed since it was invented?
   What type of technology does it represent?
   What need of civilization does it meet?
   What are the positive and negative aspects associated with this item?

3. Display your findings on an Evolution Board.

   Possible components: sketches
   models
   information sheets

4. Add your dates and item to a technology timeline with the aid of a computer.

5. Present your findings to the class. Be sure to show your Evolution Board.

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS & OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. Research the evolution of a device or process related to the occupational area being studied.

2. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   (Objectives covered in this activity under this goal):

   a. Organize the data gained from the research into a format that best communicates this information to others.

3. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Discover how the device or process was/is utilized to solve a problem facing people.

EVALUATION:
1. Effectiveness of the Evolution Board to communicate the research data.
2. Effectiveness of the class presentation to communicate the research data.

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	
4. Awareness of human elements of technology-societal implications	Advantages/disadvantages of technological advances.
5. Communications skills	Writing, organization of information.
6. Safety and health	Use of tools in construction of display.
7. Psychomotor skills	
8. Career-related information	
9. Creative problem solving	
10. Transfer of learning	Research skills.

RESOURCES:

Contact Person: Tim Taber
Tubman Middle School
280-5630

REFERENCE BOOKS AND CATALOGS:

Contact school librarian for resource materials for student use.

(ACTIVITY TITLE)

SAFETY NEWS ARTICLE

Description of Activity:

In this activity, students will identify hazards in the Technology Education facility, write and illustrate a news article about a fictitious accident that has occurred due to one of these hazards, and suggest methods that specific hazards can be avoided.

Time Needed For This Activity: 2-3 Days of Classroom Hours

Occupational Areas:

- Construction
- Communication
- Power & Energy
- Manufacturing
- Transportation

Equipment and Supplies Necessary for This Activity:

- Drawing paper
- Crayons
- Felt pens
- Rulers
- Computer & elated software (word processor, graphics illustrator, etc.)
- Dictionaries

Introduction:

Communication Technology is an important part of our daily lives. Television, radio, and newspapers require facts, observations, and opinions to be written down in a way that allows people to understand what has or is happening. The study of safety allows students the perfect opportunity to apply their communication skills to Technology Education.

In this activity, students will become reporters for a news service. Their assignment is to report on a terrible accident that has occurred in their school's Technology classroom. Their news article must include a description of the hazard encountered, an account of the accident (in graphic detail), and possible ways the accident could have been avoided. Remember, "intentional violence" is not considered an accident!

Day 1: Teacher will, following a general safety instruction, explain activity, demonstrate available equipment, give help where needed.

Student will discuss questions about assignment, identify possible safety hazards, begin work on assignment.

Assignment:

(HOMEWORK: Due next period) Write a one-half page rough draft of a news article describing an accident in the Technology lab. (Rough drafts are not finished copies and may have errors and changes needed.)

Day 2: Teacher will collect rough drafts, read several examples of student work (without names), return papers, give assistance on rewrites when requested.

Students will discuss examples of student work, edit rough drafts (students can exchange papers, if they wish), write final copy of article.

Assignment:

Students are to write a one-half page final copy of their accident article.

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS & OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. Trace the history or evolution of items of technology.

2. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   (Objectives covered in this activity under this goal):

   a. Use tools and materials to build and relay a message.

   b. Identify safe procedures.

3. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Understand systems of communication, and discuss choice.

   b. Apply problem-solving and inquiry techniques.

4. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   (Objectives covered in this activity under this goal):

   a. Discuss what impact item had/has on society.

EVALUATION: Completion of assignment, content of written work (identification of hazard, accident, avoidance suggestions), relationship of illustration to article, neatness and spelling, involvement in assignment.

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	
4. Awareness of human elements of technology-societal implications	
5. Communications skills	Application of written skills.
6. Safety and health	Accident awareness.
7. Psychomotor skills	
8. Career-related information	
9. Creative problem solving	Solutions to hazardous situations.
10. Transfer of learning	

RESOURCES:

Contact Person: Larry Wilson
Gregory Heights Middle School
Portland Public Schools
280-5600

USING THE PRINT SHOP TO INTRODUCE ELECTRONIC PUBLISHING

Description of Activity:

Most students are familiar with "The Print Shop" computer software program and have used it to produce cards, banners, or posters. This activity presents students with a graphic communications problem that requires them to use the computer as a tool to design, create art, compose messages, format copy, and reproduce their product.

Time Needed For This Activity: 2-4 Classroom Hours

Occupational Areas: Communications

Equipment and Supplies Necessary for This Activity:

The Print Shop (computer software)
Apple II, IBM, or Commodore 64 computer

Introduction:

Once upon a time, making a graphic product required a series of time-consuming steps. A designer had to draw several sketches. A layout artist had to make a paste-up that could be photographed. The negative had to be prepared and a printing plate had to be made before the final product could be reproduced. With electronic publishing, many of these processes are now performed electronically. Computer technology can be used to create art, compose messages, format copy, and make the print plate for reproducing the product. The use of computer technology in graphic arts has made producing graphic materials more efficient. The following activity will enable you to create a graphic product using computer technology.

Problem Statement:

Your student enterprise, Bright Ideas, Inc, is manufacturing picture frames. They have been designed to accommodate prom pictures. The target market is the junior and senior class. Your task is to electronically compose a one-page advertisement that can be put in the school newspaper. The advertisement needs to include a slogan promoting the product and clip art to catch the reader's eye. In addition, the advertisement needs to announce the product's price ($3) and where they can be purchased (the school bookstore).

Implementation Hints:

1. To implement this activity you will need a software package called "The Print Shop". The Print Shop can be purchased through most computer stores and software vendors. It is published by Broderbund Software, Inc, 17 Paul Dr, San Rafael, California 94903-2101, telephone (415) 479-1170. The program is available in formats for Apple II, IBM, and Commodore 64 computers. This activity was developed using an Apple IIe. Some modifications may be required if you are using a different computer.

2. The problem statement requires a student to create an advertisement for picture frames produced by a student enterprise. This is only an example. You could create a variety of problem statements that involve making labels, stock certificates, safety posters, quality control certificates, and much more.

3. Graphics library disks containing clip art are available to support the Print Shop. To simplify the documentation and to minimize the need to handle disks, the learning activity calls for a data disk to be prepared prior to implementing this activity. Using the Graphic Editor in the program, you can create a data disk by loading relevant clip art from various libraries and save it on an initialized disk. In order for your student to access the clip art, you will need to provide documentation that shows examples of the clip art and provide the names used to store the clip art on the data disk.

4. In a classroom setting, your students have three options for reproducing their computer composed copy. The first option is to use a ditto master in place of the paper in the printer. By printing the copy onto a ditto master, you are essentially making a paper printing plate that can be used on a ditto machine. After all, ditto machines work on the same principle as an offset press. This option represents an accurate simulation of basic electronic publishing using school resources.

   Your second option is to reproduce the copy using electrostatic printing technology (making copies on a Xerox machine).

   If you have the equipment, the copy can be photographed using a copy camera, a plate can be made, and the graphic product can be reproduced using an offset press. However, the purpose of electronic publishing is to minimize the need for time-consuming photographic processes.

Procedures:

1. Obtain the program titled "The Print Shop" from your instructor.

   The Print Shop can be purchased from most computer stores and software vendors. It is published by Broderbund Software, Inc, and is available for Apple II, IBM, Commodore 64, and Atari computers.

2. Make sure the computer is off. The switch is on the back of the computer on the left side. Open the disk drive door. Hold the disk with the label up and closest to you. Insert the disk so the window exposing the Mylar enters first. Gently push the disk in until you hear or feel a click when the disk is in all the way. Close the disk drive door and turn the computer on.

3. The screen will display the name of the program, publisher, and author. The main menu will automatically follow. The main menu will display a list of graphic products that can be made on the left side of the screen (greeting card, sign, letterhead, etc.). For this activity, you want to use SIGN. Use any arrow key to move the highlighted area over SIGN and press the return key. This will access the SIGN portion of the program.

4. The next display will allow you to choose a border for your advertisement. Use any arrow key to preview each border option. To select a border, move the highlighted area over the name of the border you want. Press the return key to enter your selection.

5. A menu for choosing clip art (a graphic) will appear on the screen. For this activity, we will be using the option called FROM ANOTHER DISK. Use an arrow key to position the highlighted area over FROM ANOTHER DISK and push the return key.

6. The program will ask you to remove the Print Shop disk from the disk drive. Please put the Print Shop disk back in its envelope until it is needed again. Insert the disk labeled Print Shop Data Disk in the disk drive. Make sure you close the disk drive door.

7. Examine the following pieces of clip art. Select a piece of clip art for your advertisement. To enter your selection, type the name provided and press the return key. The disk drive will engage. When the disk drive stops (when the light goes off), remove the data disk and put it back into its envelope. Remove the Print Shop from its envelope and insert it back into the disk drive. Make sure the disk drive door is closed.

TOP HAT

DANCE

CUPID

GRADUATE

CAMERA

HEART

8. A new menu will be displayed on the screen. It will ask you to choose a size for your clip art. To make your selection, move the highlighted area to either SMALL, MEDIUM, OR LARGE using an arrow key. Press the return key to enter your selection. If you have selected LARGE, go to step 11.

9. The next menu will ask you to select either a STAGGERED or a CUSTOM layout. Use an arrow to select the option you want and push the return key. If you have selected the STAGGERED option, go to step 11.

10. The next menu allows you to position clip art on the page. Use the arrow keys to move from one location option to the next. To select a location, push the return key. Your selection will become solid. If you change your mind, return to the location in question and push the return key again. The selection will become hollow again. When you have finished locating clip art, move to the rectangle labeled DONE and press the return key.

11. CHOOSE A FONT is the next menu displayed on the screen. Use any arrow key to preview each font option. Long messages need a small font. For this activity, the font called BLOCK is recommended. To select a font, move the highlighted area over the font name and press the return key.

12. Now it is time to enter your message. Your message should include a slogan, the price for the product ($3), and where the product can be purchased (the book store).

    To enter your message, simply type it in. The program will automatically center the text on the screen. To move to the next line, press the return key. To erase parts of a line, simply back the cursor over the unwanted section using an arrow key. To erase a complete line, move the cursor to the unwanted line, hold the control key down, and press the letter E.

    Text can be moved to the right or the left side of the screen line by line. To move text, use an arrow key to move the cursor to the line you want to move, hold the control key and press the letter P.

    You can also change the form of the text (solid letters, outlined letters, or 3D letters) line by line. To change the form of the text, move the cursor to the line you want to change, hold the control key down, and press the letter F.

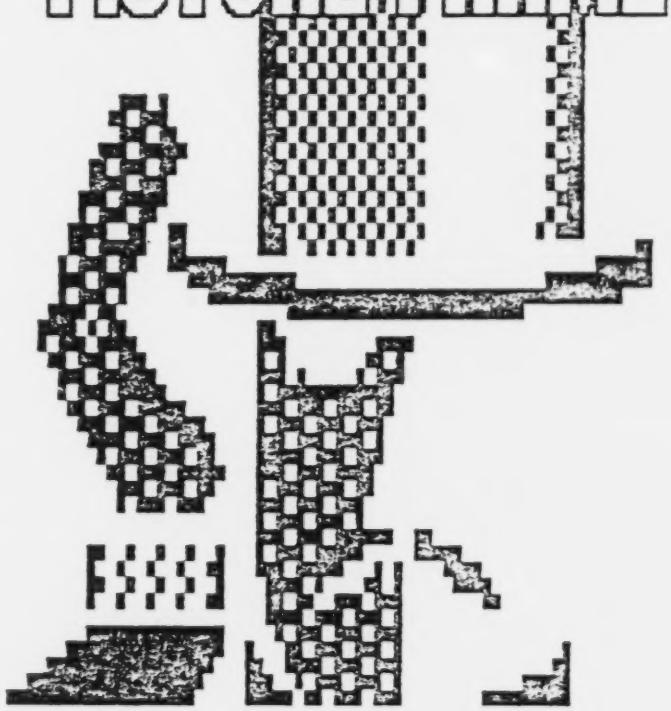
    Lastly, you can change the size of the text in a given line. To change text size, move the cursor to the line you want to change, hold the control key down, and press the letter S.

    When you have finished entering your message, move the cursor off the page using the return key. If you did not fill the page, the program will ask you if you want the text centered or not. Select yes or no and press the return key.

13. The last menu will allow you to print your graphic product. Make sure the printer is on. Advance the paper in the printer so the perforations between two pieces of paper is under the print head. Move the highlighted area over "*** PRINT ***" and press the return key. First, the disk drive will engage. Then the word "THINKING" will be displayed on the screen. This will be followed by the word "PRINTING". Lastly, the printer will begin printing your advertisement. Do not be alarmed if the printer stops in the middle of your advertisement. The computer will pause, display the word "THINKING" again, and then it will begin printing again.

14. When the printer is done, advance the paper and tear off your advertisement.

LIKE YOUR FACE,
FRAME IT WITH A
BRIGHT IDEAS
PICTURE FRAME



ONLY $3.00 IN THE
BOOK STORE

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. Contrast methods of past graphic composition and electronic graphic composition.

2. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   (Objectives covered in this activity under this goal):

   a. Explore electronic composition and publishing by using a computer and "The Print Shop" computer software program.

3. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Use the computer as a problem-solving tool for designing, modeling, and producing a solution to a graphic communications problem.

4. Explore and develop understanding of the systems of technology, how systems are controlled, and how systems are used to solve problems.

   (Objectives covered in this activity under this goal):

   a. Identify the communications systems used to relay desired message.

5. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   a. Discuss the effects that electronic publishing will have on the graphic communications industry.

   b. Discuss how electronic composition will affect the job requirements of people entering the graphic communications industry.

EVALUATION: Evaluate product as to time needed to prepare, clarity of message, readability, and vote of class as to desirability.

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	
4. Awareness of human elements of technology-societal implications	Societal implications.
5. Communications skills	Using written language, art, and format to communicate a message.
6. Safety and health	
7. Psychomotor skills	
8. Career-related information	
9. Creative problem solving	
10. Transfer of learning	

RESOURCES:

Contact Person: John Granger
Warrenton High School
861-3317

REFERENCE BOOKS AND CATALOGS:

"The Print Shop" - Published by Broderbund Software, Inc,
17 Paul Dr, San Rafael, California 94903

(ACTIVITY TITLE)

PRODUCT ADVERTISING

Description of Activity:

Design a label, evaluate advertising appeal, and produce a radio ad.

Time Needed For This Activity: 4 Classroom Hours

Occupational Areas:

Communication

Equipment and Supplies Necessary for This Activity:

Notebook paper
Pencil
Can labels (examples)
Tape recorders

Procedure:

Day 1: Discuss product advertising and show some examples of can labels.

Students will:
- Choose a product (make believe is okay)
- Create a graphic
- List ingredients

Homework:
- Hand out appeals of commercials
- Watch television for the advertising; determine appeal and record time

Day 2: Share appeal of commercials data - list on board.

Students will:
- Determine which type of appeal is used most/least
- Discuss and give examples of what was observed
- Evaluate what kind of appeal your can label has
- Work in class to complete can ad

Day 3-4: Write and produce a radio ad for can product.

Students will:
- Problem-solve to determine approach
- Write script - determine length in seconds
- Rehearse and record
- Play for class

M.I.T.
ADVERTISING AND MARKETING

Name:_____ Period:_____

DESIGN A LABEL

You have just been hired as a label artist for the "Bent" Lid Food Corporation". Your first assignment is to design a label for a 16-oz can of Super Duper Corned Beef Hash. Draw your front and back label creations on the cans below. Color it in. Your label is required by law to have items A, D, E, and F.

A. Ingredients in order by weight

B. Ingredient in largest amount

C. Ingredient in smallest amount

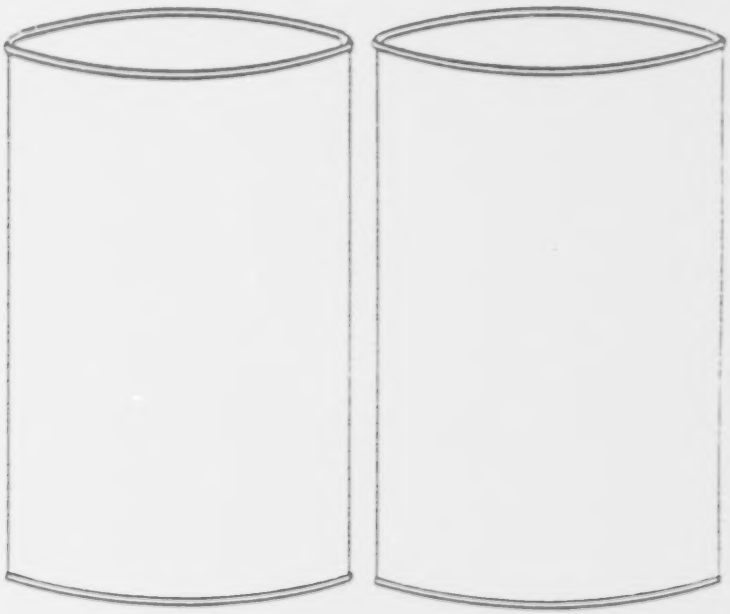
D. Name and address of manufacturer

E. Weight

F. Nutrition information

G. Guarantee

H. Name of product.



M.I.T.
ADVERTISING AND MARKETING

Name:_____ Period:_____

APPEAL OF COMMERCIALS

Program:_____

Time:_____ Audience:_____

(1) Humor; (2) Rhyme, jingles, songs, slogans; (3) Cute animals, babies, etc.; (4) Sex appeal; (5) Masculine/feminine; (6) Snob appeal; (7) Identification; (8) Guilt - good mother, good wife; (9) Science - special ingredients or formula; (10) Ego-wisdom; (11) Comparisons; (12) Economy; (13) Brings happiness, security; (14) Natural; (15) Ecology, consumer savings, etc.; and (16) Other

Product	Appeal	Length
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		

Were there any hidden commercials? If so, for what?

M.I.T.
ADVERTISING AND MARKETING

Name:_____ Period:_____

Sketch:

Materials:

Notebook paper

Total Cost:

Tools and Equipment: Pen

Step-By-Step Procedures:

References:

Information:

Commercials are used to get people to buy a certain product. The people making the commercial know that many people value certain things (beauty, money, health); therefore, they tell or show the viewer that their product will help them to get what they value.

1. Write a radio commercial stating:

   a. What you are selling

   b. Who you are trying to get to buy the products

   c. What you think they value that will make them pay attention to your commercial.

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. Discuss the evolution of advertising from billboards, signs, television, etc.

2. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Students will design and illustrate advertising.
   b. Students will use tape recording to imprint ideas to others.
   c. Students will problem-solve what makes a good advertisement.

3. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   a. Discuss what advertising does to affect us in our everyday lives.

EVALUATION: Each student will design a label for a product, write and produce a radio advertisement, and evaluate television commercials.

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	
4. Awareness of human elements of technology-societal implications	
5. Communications skills	
6. Safety and health	
7. Psychomotor skills	
8. Career-related information	
9. Creative problem solving	
10. Transfer of learning	

RESOURCES:

Contact Person: Jim Anderson
West Sylvan Middle School
286-5690

REFERENCE BOOKS AND CATALOGS:

M.I.T. Manuals
Advertising and Marketing

SECTION 3

MANUFACTURING ACTIVITIES (TLA)

POSSIBLE WAY TO TEST FOR WORKHARDENING IN THE SCHOOL METAL SHOP

Description of Activity:

Make a simple device that will tell the student when to stop working on their materials and start the annealing process. This would cover all of your art metal processes, such as metal spinning, beating down, raising a metal, etc.

Time Needed For This Activity: 1 Classroom Hour

Occupational Areas:

Construction
Communication
Power & Energy
Manufacturing
Transportation

Equipment and Supplies Necessary for This Activity:

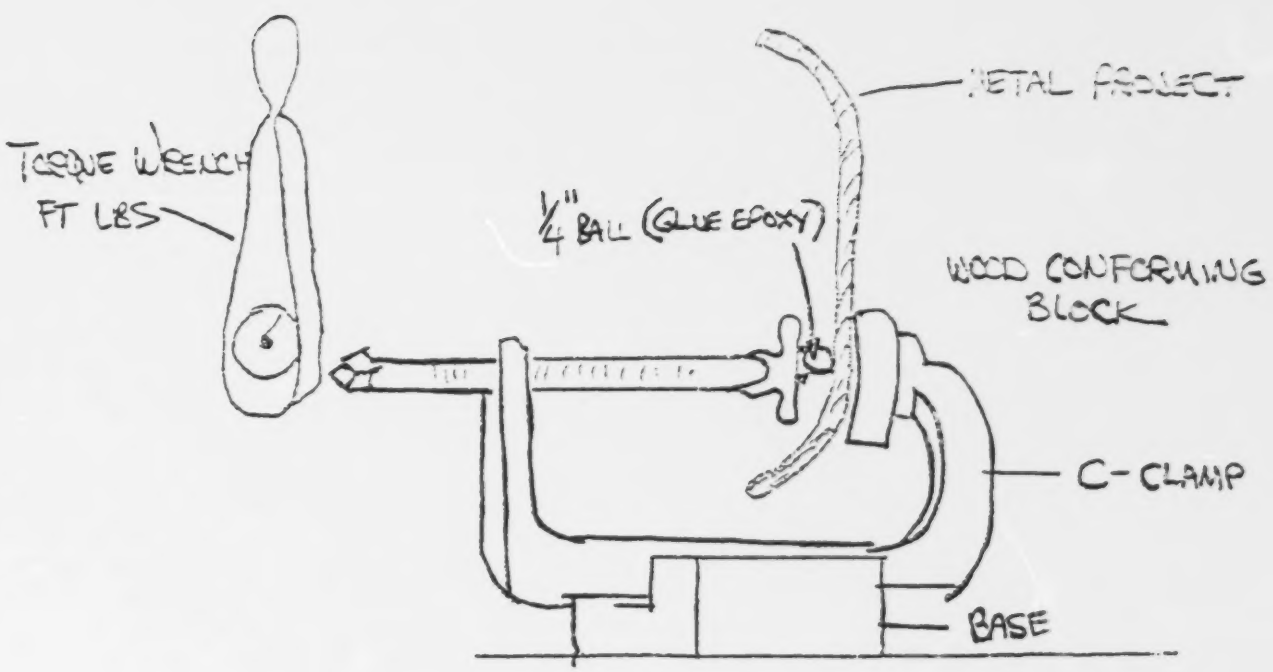
C Clamp
Torque wrench
Micrometer (ball type)
Metals (such as aluminum, copper, and brass)

Problem:

In the school shop, to keep students from overworking many of the non-ferrous metals, a simple means of checking the material is needed.

Procedure:

Material to be worked is first penetrated with C-clamp and ball to certain depth. This is accomplished by use of torque wrench on C-clamp, and a reading is then taken with the ball micrometer. This testing procedure is repeated after the material is worked and a new reading should be secured. By trial and error method, various charts can be devised for metals used. A student could now tell by testing and measuring when to stop and anneal his metal before continuing his work.



Copper			
Scale of Hardening			
pressure ft lbs.		penetration.000"	
before	after	before	after

78

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. Understand and discuss the evolution and testing of materials.

2. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   (Objectives covered in this activity under this goal):

   a. Identify tools and materials.

3. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. List material testing processes.

   b. Problem-solving and research techniques.

4. Explore and develop understanding of the systems of technology, how systems are controlled, and how systems are used to solve problems.

   (Objectives covered in this activity under this goal):

   a. Describe modern testing technology.

5. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   a. Identify advances in testing materials.

EVALUATION: Does test unit determine hardness of material?

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	
4. Awareness of human elements of technology-societal implications	
5. Communications skills	
6. Safety and health	
7. Psychomotor skills	
8. Career-related information	
9. Creative problem solving	
10. Transfer of learning	

RESOURCES:

Contact Person: Gary Davidson
Robert Grey Middle School
Portland Public Schools
280-6576

Industrial Arts/Technology Learning Activity

Using "The Factory" to Introduce Computer-Aided Manufacturing

Description of Activity:

This activity gives students the opportunity to explore computer-aided manufacturing and problem-solving through an easy-to-use computer software package. This material can be used as an individual student learning station or as a group activity in a computer lab setting.

Time Needed For This Activity: 2-5 Classroom Hours

Occupational Areas:

Manufacturing

Equipment and Supplies Necessary for This Activity:

The Factory (computer software)
Apple II, IBM, or Commodore 64 computer

Introduction:

Producing a product requires a lot of information processing. Before automation (control through automatic devices instead of human beings), people had to read plans, plan production systems, and operate production machines. Machine operators often had to perform the same task over and over again. One form of using computers to automate a production system is called "computer-aided manufacturing", or CAM. CAM systems use computer technology to help plan, control, and manage production systems. In industry, CAM can often be used to test a production system in the form of a computer simulation. The simulation allows the user to evaluate, correct, or refine the CAM procedure without actually making a product. During this activity, students will experience CAM concepts through a computer simulation.

Problem Statement:

You are a production engineer for the ACME Widget Corporation. Your company makes widgets (small flat squares that often feature holes and stripes). The company uses a CAM system to make their widgets. When a new widget design appears on the screen, you need to program a series of machines to produce the widget. When you finish programming your production system, you can test it by making a widget. If you program the production system correctly, your widget will match the design. If you make a mistake, your product will have a flaw. Try not to make too many defective widgets.

Implementation Hints:

The Factory can be purchased from most computer stores and software vendors. It is published by Sunburst Communications, Inc, and is available for Apple II, IBM, and Commodore 64 computers.

Procedures:

1. Obtain the program entitled "The Factory" from your instructor.

2. Make sure the computer is off. The switch is on the back of the computer on the left side. Open the disk drive door. Hold the disk with the label up and closest to you. Insert the disk so the window exposing the Mylar enters first. Gently push the disk in until you hear or feel a click when the disk is in all the way. Close the disk drive door and turn the computer on.

3. The screen will display the Sunburst logo first. The main menu will automatically follow. The main menu will list three activities: Test A Machine, Build A Factory, and Make A Product. Test A Machine will enable you to experiment with the machines featured in the program (Punch, Rotate, and Stripe). To access Test A Machine, just press the return key.

4. The program will automatically display a workcell (a hollow box), a piece of standard stock (a solid box), and a list of the machines featured in the program. Using the arrow keys, move the box to the machine you want to experiment with first. Press the return key.

   Next, the program will ask you to select an operation. Again, use the arrows keys to select an operation and press the return key. When the last operation has been entered, the standard stock will be fed into the machine, processed, and displayed on the screen. Press the return key to continue.

5. The next screen will ask you if you want to test another machine. You should try each machine at least once. If you do not understand what each machine can do, it will be difficult to perform the more advanced activities. Move the box to your selection using the arrow keys and press the return key. Repeat the experimentation process described in step 4 until you feel comfortable with each machine.

6. When you have finished experimenting with the machines, the program will return to the main menu. Your next activity will be to Build A Factory. This activity is a lot like Test A Machine. This time, you will be able to create and test a sequence of machines. Using an arrow key, move the box to the number 2 and press the return key.

7. The next screen will display eight workcells (hollow boxes) and a list of commands at the bottom of the screen. Use the same procedures you used to Test A Machine to program the first workcell. If you want to execute the production sequence without programming every cell, select the DONE command and press the return key. When all the workcells have been programmed, of if you select the DONE command, the production sequence will process the standard stock and display the finished product.

8. Next, the program will ask you if you want to challenge someone. For the purposes of this activity, select NO by pressing the return key.

9. The next screen will ask if you want to build another factory. Make your selection and press the return key.

10. When you have finished experimenting with Build A Factory, the program will automatically return you to the main menu. Using an arrow key, move the box to the number 3 and press the return key. This will access the Make A Product portion of the program.

11. The next screen will ask you to select a level of difficulty for the activity. Even though you are brilliant, select EASY and press the return key. The next screen will display "Your Challenge". Your task will be to program a production sequence to manufacture the displayed product. Press the return key to continue.

12. The program will display eight workcells (hollow boxes), the product (your challenge), and a list of machines. This activity works a lot like Build A Factory. However, this time you have to program a sequence of machines to build a specific product. Examine the product carefully. Identify the production process that had to occur first. Program the first workcell to perform that process. If needed, determine the next production process and program the next workcell. If you think you have made a mistake, use the BACK-UP and/or ERASE command to make corrections. You may not need to program every cell to manufacture the product.

13. When you have finished programming the production sequence, select the DONE command and press the return key. Standard stock will be automatically fed into the production system. The stock will be processed and the final product will be displayed on the screen. If the production system was programmed correctly, both products will look the same and the program will tell you the product is correct. If a programming error was made, the two products will look different and the program will tell you there is a flaw in your product. Press return to continue.

14. The program will ask you if you want to make the product again. If you made the product correctly, select NO and press the return key. If there is a flaw in the product and you want to try it again, select YES and press the return key.

15. The program will ask you if you want to make another product. Select YES and press the return key. You will need to select a level of difficulty next. Now that you understand how to Make A Product, you may want a more difficult challenge. You may want to select MEDIUM or, if you are brave, HARD. Make your selection and press the return key.

16. The program will display your new challenge. Examine the product carefully. Identify the operation that needs to occur first. Program the first workcell to perform that operation. Now, determine the second operation needed to make the product. Program the second workcell to perform the operation. Continue this process until the production system is complete.

Don't forget, you can use the RETURN and the ERASE commands to correct mistakes during the programming process. To execute your production system, select the DONE command and press the return key. If your programming is correct, your product will match the one displayed on the screen. If a mistake has been made, the program will tell you there is a flaw in the product and you can try again. Good luck making widgets.

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   (Objectives covered in this activity under this goal):

   a. Use the computer to sequence a series of machines necessary to product a given product.

2. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Develop and utilize program-solving techniques, such as "working backwards" or "trial and error".

   b. Discuss how computer modeling could be used by industry to solve production problems.

3. Explore and develop understanding of the systems of technology, how systems are controlled, and how systems are used to solve problems.

   (Objectives covered in this activity under this goal):

   a. Discuss how the use of the program "The Factory" could be used to drive a computer-aided workstation.

   b. Sketch a computer-controlled workcell that could be drive by this program.

4. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   a. Discuss how the use of computer-aided manufacturing would affect the qualifications and training of workers.

EVALUATION:

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	Recognition and application of rotation measured in degrees
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	
4. Awareness of human elements of technology-societal implications	Societal implications.
5. Communications skills	
6. Safety and health	
7. Psychomotor skills	
8. Career-related information	
9. Creative problem solving	Development and application of problem-solving techniques, such as working backwards and trial and error.
10. Transfer of learning	

RESOURCES:

Contact Person: John Granger
Warrenton High School
861-3317

REFERENCE BOOKS AND CATALOGS:

Sunburst Communications, Inc
1-800-431-1934

The Factory (Apple II, IBM, or Commodore)

Super Factory (a 3-D version of this same program, for students looking for a higher level of problem-solving challenge.

EFFECT OF ALLOYING METALS ON THE CORROSION AND OXIDATION OF STEEL

Description of Activity:

How would you compare the effects of dilute nitric acid upon plain carbon steel and stainless steel? How would you test their resistance to oxidation?

Time Needed For This Activity: 30 Classroom Minutes

Occupational Areas:

Manufacturing

Equipment and Supplies Necessary for This Activity:

75 ml of concentrated nitric acid (67% HNO_3)
2 beakers (250-500 ml capacity)
Strips of stainless steel
Strip of low-carbon steel
Lab tongs, forceps, or pliers
Meeker burner
Nail file

The Experiment:

Prepare a 15% solution of HNO_3 by: Mixing 75 ml of concentrated (67%) nitric acid with 425 mil of water. Pour half of the solution into each of two small beakers (250-500 ml capacity). Dip the unheated end of the stainless steel into one beaker and the unheated end of the plain steel into the other. What happens to each piece of steel?

Now, make a deep scratch on the stainless steel with a nail file and place it again in the beaker of acid. Does the scratch affect the corrosion resistance of the stainless steel? Now, rinse each strip in clear water, dry, and then clamp the acid-treated ends of both strips in a ring stand. Heat the unsupported ends in the flame of a Meeker burner adjusted to obtain the highest possible temperature. Not the "temper colors" that form on both strips. Temper colors are the various hues imparted to steel at different temperatures. Continue to heat the ends for about 10 minutes until they are glowing as brightly as possible. Remove the flame and allow the strips to cool for five minutes or until they can be handled comfortably. Compare the colors and conditions of each strip. Now, using pliers, bend sharply the heated end of each strip. What happens?

Industrial Applications:

Carbon steels are comparatively inexpensive and can be protected by oil, paint, zinc, tin, or other coatings. They are used in many applications, from bridges and buildings to machinery parts, tin cans, and countless other products where low cost is a factor.

Stainless steels are costly, but are resistant to oxidation and corrosive attack. They are used for dairy equipment and food handling vats and machinery where cleanliness and freedom from contamination are essential. Their sheen and toughness make them ideal for kitchen utensils and equipment. Modern automobiles are decorated with stainless steel trim. Because of its luster, stainless steel is used in ash trays, furniture trim, lighting fixtures, and many other decorative applications in modern homes.

Background Technical Information:

Plain carbon steel is composed principally of iron and carbon. It is not resistant to corrosive attack. Because of its affinity for oxygen, plain steel will oxidize or rust rapidly when exposed to weather or water. The oxidation is speeded when high temperatures are applied. For protection against atmospheric corrosion, plain steel must be protected by paint or other coatings. Tin cans, galvanized garbage pails, and lead-and-tin-coated steel (known as terne-coated steel or terne plate), as in automobile gas tanks, are all made from protectively-coated steels.

Stainless steel is composed principally of iron with nickel and chromium as alloying elements. The addition of sufficient quantities of chromium and nickel causes a microscopically-thin oxide to form on the steel. This oxide is very resistant to most acids and alkalies and, once formed, is impervious to further oxidation, even in the presence of heat. If the thin film is broken by filing or other abrasion, the alloy immediately unites with oxygen and forms another thin, impervious film. Thus, stainless steel is heat resistant and rustproof all the way through. This quality keeps the steel bright and undamaged.

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. Discuss the evolution in use of different metals and materials to avoid corrosion characteristics.

2. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Apply research and planning procedures.

3. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   a. Discuss how the emergence of new materials affects our lives and jobs.

   b. List or make a display board showing the evolution of materials.

EVALUATION: Based on the success of the experiment, participation in discussions, and the technical content of display board.

INTERDISCIPLINE AREAS	LEARNING CONSIANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	
4. Awareness of human elements of technology-societal implications	
5. Communications skills	
6. Safety and health	
7. Psychomotor skills	
8. Career-related information	
9. Creative problem solving	
10. Transfer of learning	

RESOURCES:

Contact Person: Gary Davidson
Robert Grey Middle School
Portland Public Schools
280-5676

Industrial Arts/Technology

THE BOOKMARK FACTORY: SCARCITY

Description of Activity:

This is an activity that is a simulation and discussion of the effects of Scarcity.

Time Needed For This Activity: 1 Classroom Hour

Occupational Areas:

Manufacturing

Equipment and Supplies Necessary for This Activity:

Scissors
4" x 4" yellow paper squares
Black crayons or felt pens
3" x 8" rectangles of white paper
Stapler
Elmer's glue

M.I.T. ACTIVITY

Name: _____ Period: _____

THE BOOKMARK FACTORY: SCARCITY

Concept/Generalization:

Scarcity

There are a limited amount of products and resources in the world in which we live.

There is not enough for everyone to have all that he/she needs or wants; therefore, people must make choices.

Objective:

Given a simulation and discussion, the pupil will demonstrate an understanding of scarcity and the effects of scarcity by:

a. Participating as a worker in the Bookmark Factory
b. Participating in the debriefing discussion

Activity Description:

1. Instruct pupils that they are going to be workers in the Bookmark Factory. Tell them that they will be producing bookmarks. Show them a completed bookmark. (An example of the bookmark is on page 88.)

2. Divide pupils into three groups. Assign one leader to each group. (Later, the leaders will represent their groups in trading supplies.)

   NOTE: The supplies will be distributed in an uneven manner. This is done deliberately as this is a very important part of the lesson necessary to teach scarcity.

3. The pupils should be told that:

   a. These are the supplies for their factory.
   b. Some of the supplies were delayed getting to the factory.
   c. They must get along the best way they can.
   d. They must produce as many bookmarks as they can.

4. Distribute the supplies in the following manner:

	Group A	Group B	Group C
Scissors	12	2	1
Yellow paper	10	15	50
White paper	15	50	10
Black crayons	1	2	12
Glue	2	3	1

Show them how to make the bookmark and then let the groups begin production.

5. The pupils in each group will quickly see that they have a limited supply of at least one resource they need to make the bookmark.

   At this point, expect some confusion and complaints. Stop the simulation and tell the students that they are experiencing scarcity.

6. Print the word "scarcity" on the blackboard and discuss the following questions. As in previous lessons, ask pupils to quietly share their answers with a neighbor before sharing with the total class.

   a. What resources do you have that are scarce?
   b. Do you have any resources which are in great supply?
   c. Which is your most valuable resource? Why?
   d. How can you get some more needed resources?
   e. Will anybody trade some of their resources for some of yours?
   f. Are you willing to give away some of your most scarce resources? Why or why not?
   g. Are you willing to give away your most abundant resource? Why or why not?

7. Explain to the pupils that the leaders in the groups may discuss with their workers options for trading resources with another group. If one group has surplus scissors, but not enough paper, perhaps they could trade with a group that has surplus paper and needs scissors. The leaders are the only people who can move from the group that has surplus paper and needs scissors. The leaders are the only people who can move from the group to trade supplies. They must trade; they may not give supplies away.

8. Continue the simulation for about 10 minutes. Stop production and count the number of bookmarks each group has produced and write the numbers on the board.

   Ask the following questions involving all pupils in the discussion:

   a. Which group has produced the most? Why?
   b. Which group has produced the least? Why?
   c. What resources do you need to produce more bookmarks?
   d. Do you have extra resources that you do not need? Why?

   NOTE TO THE TEACHER: This is not a lesson on competition. It is necessary to discuss the total amount of bookmarks produced to see how the groups used their scarce resources to produce their bookmarks. One group may not have produced many bookmarks because they didn't have enough supplies; consequently, production had to stop.

9. To help pupils to transfer this understanding to the real world, discuss the possibilities of this happening to factories or businesses in their community. Relate this to the apple business. Ask the question, "Are apples being produced in the winter? Why or why not?"

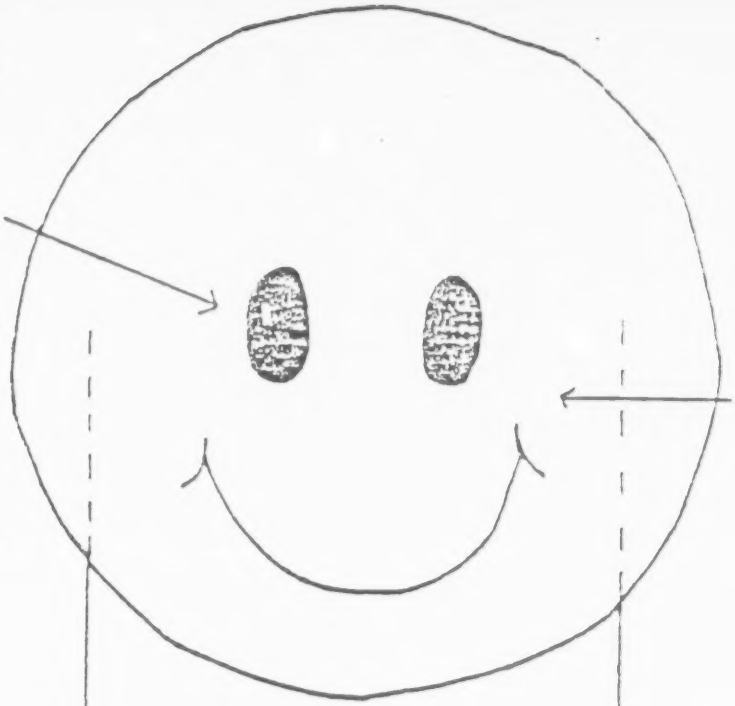
10. Tell the pupils that in the next lesson they will have another opportunity at being workers in the Bookmark Factory and that all the resources will be equally distributed.

11. Save the bookmarks to be used later in the unit. The students will use these bookmarks as a gift to be given to each customer that buys the book they will be producing.

SAMPLE DITTO FOR HAPPY FACE BOOKMARKS

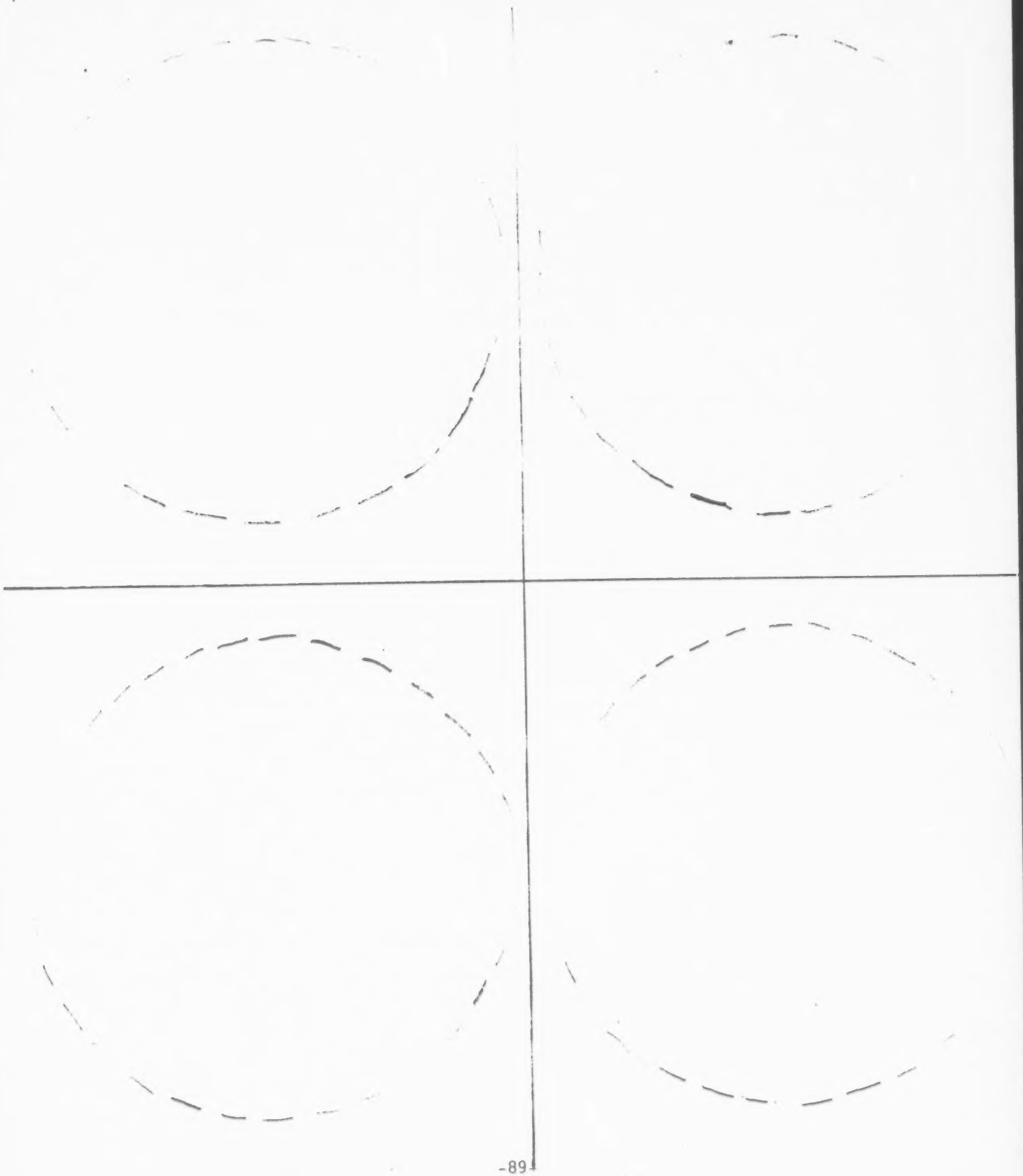
1. RUN OFF DITTO ON YELLOW CONSTRUCTION PAPER.
2. CUT APART ON HEAVY LINES WITH PAPER CUTTER.
3. GIVE THE SQUARE TO FACTORY GROUPS.
4. PUPILS CUT OUT CIRCLES AS PART OF THE BOOK FACTORY ACTIVITY.

SAMPLE BOOKMARK



JOBS:

1. CUT CIRCLE.
2. PUT EYES AND MOUTH ON CIRCLE.
3. GLUE CIRCLE TO RECTANGLE.



MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. Discover and display the evolution of mass production.

   b. List some of the who's who in the history of mass production and what their contributions were.

2. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   a. Students will experience a shortage (scarcity).

   b. Students will problem-solve and negotiate with other groups for solution.

3. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Discuss reasons for mass production.

   b. List major changes in mass production today.

4. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   a. Design, set up, and develop as many systems as possible to produce a product.

5. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   a. Report on how mass production has changed our world, and may continue to change our society.

EVALUATION: Students will participate as a worker in a bookmark factory and product bookmarks.

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	Production systems.
2. Mathematics concepts	Product costs and profit.
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	
4. Awareness of human elements of technology-societal implications	
5. Communications skills	
6. Safety and health	Proper use of tools.
7. Psychomotor skills	
8. Career-related information	Identify jobs.
9. Creative problem solving	Designing, set-up, and production of product, and systems to handle production.
10. Transfer of learning	

RESOURCES:

Contact Person: Jim Anderson
West Sylvan Middle School
286-5690

REFERENCE BOOKS AND CATALOGS:

The Book Company - Washington State Council on Economic Education, 1980.

SECTION 4

POWER & ENERGY ACTIVITIES (TLA)

INDUSTRIAL ARTS/TECHNOLOGY

A 79¢ SOLAR COLLECTOR

Description of Activity:

This article describes the construction of an inexpensive solar panel which can be utilized to demonstrate and experiment with the fundamental principles of solar energy.

Time Needed For This Activity: 1-2 Classroom Hours

Occupational Areas:

Power & Energy

Equipment and Supplies Necessary for This Activity:

Empty 3.8 liter milk carton
Newspaper
Aluminum foil (1 piece approx 60 cm long)
1.38 liter juice can
Flat black paint
60 cm piece of 6mm copper tubing (may be purchased at a local hardware store at approx cost of 79¢)
Small pieces of wire
Masking tape
Plastic report cover

Many solar energy experiments can be performed using this simple panel. A few experimental ideas are listed below:

- Make two collectors; paint one white and one black; compare the results.
- Make two identical collectors; put two covers on one panel; compare the results.
- Connect several panels together using plastic tubing and compare with a single panel.
- Research thermosiphoning and operate the panel in this fashion.
- Test your collector on a partly cloudy day and compare the results with those from a sunny day.
- Test your collector at different times of the day.
- Tilt your collector at different angles (or use several collectors at different angles) to the sun's rays and compare the results.

These and many other experiments can easily be done in the elementary or middle school classroom using this simple collector.

STEP A

1. Take handle off milk carton and fold that end up to make a rectangle (just tape it up, but not too securely).
2. Cut out one side of the box (one of the long sides).
3. Cut 3.75 cm off the top of the box.

STEP B

1. Make two holes approximately 6 mm in diameter (use a pencil) in both ends of the box. (Locate the holes at opposite corners and not too close to the edge.)

STEP C

1. Paint the whole inside black.

STEP D

1. Shred newspaper into strips and wrap it into a piece of aluminum foil.
2. Place the wrapped newspaper in the bottom of the milk carton. Mold it to fit snugly.

STEP E

1. Remove the top and bottom from a large juice can.
2. Cut it in half or flatten it and tape the sharp edges with masking tape.

STEP F

1. Bend approximately 60 cm of copper tubing into an "S" shape.
2. Make it so that it will fit into the box, using the two holes you have already made.
3. Make sure the tubing doesn't touch the sides of the box.
4. Try to have the tubing touch the can as much as possible. Punch holes in the can and attach the copper tubing using wire, if possible.
5. After the tubing is in place, paint the can and tubing black.
6. Place the tubing and can inside the milk carton on top of the shredded newspaper.

STEP G

1. Cut the corners of a plastic report cover.
2. Fold the corners down to fit the top of the box and tape the sides down with masking tape. It should form a cover.
3. The panel is now ready to attach to a water source using the plastic tubing.
4. Check the inlet and outlet water temperature.

ACTIVITY 3
SOLAR ENERGY PUZZLE

T H K L E N E R G Y A C Z S Q U L W X E K G T H L
L M S Q S M G P A L I M E X K I M J B D F I L O L
R W X U P Z L R K E T S R S T R A T O S P H E R E
S M O P I Q U H E L E O E R C M Z Q U B D X L K C
S I T Z L B F E G E X K H O P K D H V O I F G U C
S B E C C M O A M Q N M P L E R B R F T L G M W I
T X U K E A P T H T P H S C W X O O L S D M E C A
O H P O L U L T R A V I O L E T M T P R S O L D T
P B E G P W H R M R N U P U O A Z C C O B L O F L
S R V R P B I A C V S G O X S R V E P E M W K V O
N F L N M S H N V C R A R E C E S D X N L A M N V
U V R C Z O A S D M K D T M A B G N U D J L O C O
S T J L S G M F H M A O F T L N K O T L F I O K T
A R G Y O M Q E E N I I J S D U O L C U T E E E O
M O S H M O E R T U D L U P Q R S G S A E P D M H
B A I F H Q G K L E M F L Y W H E E L H R I N Q P
R P S M X B N O U P R V M Z K C P U R Y G P E K P
L V S H J S A I T S S P I Q R T S L F R P R T G A
Z F H O V A H M X Y O A O S S N M O L S E E O M O
O A T W T R C S P O L L U T I O N L E H Y P O E R
D R N M A M X D L Y A J A I U B F U P V G P B P E
K S Y Z S E E V E R R S E R J W L S X U J O I G F
O U S P E C T R U M E N F K I U O E G M G C A W L
A G O H A X A M D I N Z L H K M Y N L S M T C O E
P L T E M P E V L F E U B C T L E T Z I H K K S C
G X O D K O H P U Y R W M A Q T J T R K G M B M T
F E H U F H T M T K G D H M E N K S E C Z H N T O
T D P R L U H K B W Y N O I T A I D A R A M T O R

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1. ATMOSPHERE
2. BTU
3. CLOUD
4. COPPER PIPE
5. ECLIPSE
6. ENERGY
7. FLYWHEEL
8. GREENHOUSE
9. HEAT EXCHANGE
10. HEAT TRANSFER
11. INSULATION
12. PHOTOSYNTHESIS
13. PHOTOVOLTAIC CELL
14. POLLUTION
15. RADIATION
16. REFLECTOR
17. SOLAR ENERGY
18. SOLARIMETER
19. SPECTRUM
20. STRASTOSPHERE
21. SUNSPOTS
22. THERMOMETER
23. TROPOSPHERE
24. ULTRAVIOLET
25. VISIBLE LIGHT
26. WINDMILL

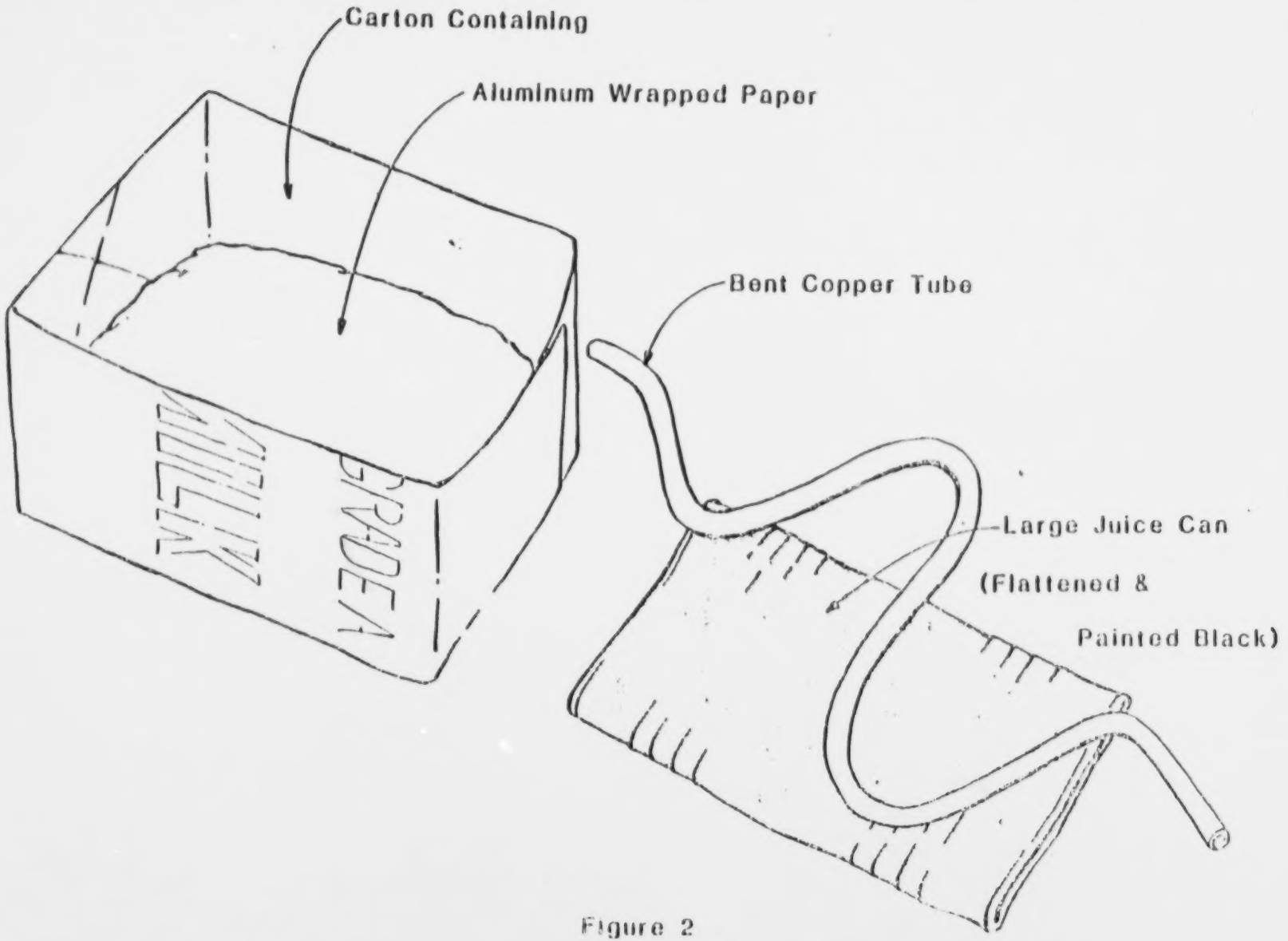
Carton Containing
Aluminum Wrapped Paper
Bent Copper Tube
MILK
GRADE A
Large Juice Can
(Flattened &
Painted Black)

Figure 2

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. Report and describe early energy uses.

   b. Date early energy discoveries and uses.

2. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   a. Use tools and materials to construct solar collector.

   b. Identify materials, methods, costs, time.

3. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Design solar collector; designing problem-solving, modeling.

   b. Build solar collector.

   c. Test solar collector (testing procedures).

4. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   a. Explain the use of solar energy.

   b. List other uses of solar energy.

5. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   a. Discuss the impact of solar energy on your lives in years to come.

EVALUATION: Use the solar collector to heat water and cool a food item for consumption. Was the experiment satisfactory?

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	
4. Awareness of human elements of technology-societal implications	
5. Communications skills	
6. Safety and health	
7. Psychomotor skills	
8. Career-related information	
9. Creative problem solving	
10. Transfer of learning	

RESOURCES:

Contact Person: Gary Davidson
Robert Grey Middle School
Portland Public Schools
280-5676

REFERENCE BOOKS AND CATALOGS:

_____, by Ann Lewis, Moscow High School, with assistance from Wayne Hager, Associate Professor, University of Idaho, and Aleta Sonnenberg, Graphic Artist, University of Idaho, Moscow, Idaho.

INDUSTRIAL ARTS/TECHNOLOGY

THE ELECTRICAL CONDUCTIVITY OF WOOD

Description of Activity:

Using a length of extension cord, attach to each end a plug (of the regular household variety) with parallel prongs. At the center of the cord, attach a galvanometer to one of the wires. Next, sharpen the prongs of one of the plugs to points so that it can be driven into a piece of soft wood. It is not necessary to drive them deeper than just below the surface of the wood. Connect the other plug to a power supply or to a set of dry cells, in which case, the second plug is not necessary.

Time Needed For This Activity: 1-2 Classroom Hours

Occupational Areas:

Transportation
Power & Energy

Equipment and Supplies Necessary for This Activity:

Extension cord (household variety)
Galvanometer
Soft wood
Water
Power supply or set of dry cell batteries

Dry wood offers such a marked resistance to the passage of an electric current that it is classed as a non-conductor.

Experiment:

Obtain several pieces of a soft textured wood and determine their conductivity under the following conditions:

Dry wood
Wet wood (soaked several days)
Heated wood: room temperature
150° F
200° F

Questions:

What is the effect of moisture content on the electrical conductivity of wood?

What is the effect of temperature on conductivity?

What important uses of wood are dependent upon it electrical resistance?

The electrical resistance of wood varies somewhat in different species. It is greater across the grain than along the grain of wood, and is affected by change in temperature, approximately doubling with each decrease of 22.5° F. The most significant effect on conductivity, however, is moisture content. As a piece of wood dries from the fiber-saturation point (about 30% moisture content) to the oven-dry condition, the electrical resistance increases about a million times! It is important, therefore, that the wood be dry in order to offer the best electrical resistance.

The most important uses of wood which utilize its property of electrical resistance are found in telephone poles, tool handles, railroad ties, and wooden vats and storage tanks.

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. Research and discuss the discovery of electricity.

   b. Identify early conductors of electricity.

2. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   a. Safely hook up and use electrical power sources and meters.

3. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Document testing process in scientific order.

   b. Compare different conductors.

4. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   a. Identify new conductors and study how they work (i.e., superconductors).

5. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   a. Report or discuss the contribution electricity and new conductors have had on your lives.

EVALUATION: Accuracy and neatness of reports. Participation in discussions.

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	Awareness of formulas for conductivity.
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	Conductivity electrical theory; advances in conductivity.
4. Awareness of human elements of technology-societal implications	
5. Communications skills	
6. Safety and health	
7. Psychomotor skills	
8. Career-related information	Who works with electricity?
9. Creative problem solving	Proper set-up and reporting to daily lives.
10. Transfer of learning	

RESOURCES:

Contact Person: Gary Davidson
Robert Grey Middle School
Portland Public Schools
280-5676

REFERENCE BOOKS AND CATALOGS:

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INDUSTRIAL ARTS/TECHNOLOGY

AN INSTRUCTIONAL UNIT ON SOFT SOLDERING

Description of Activity:

The process of soft soldering is of tremendous importance to every modern electrical and electronics industry. It is widely used as an economical method of making electrical connections on all kinds of equipment. The purpose of this unit is to help students understand the behavior of solder and the technique of making a satisfactory soldering electrical connection. This unit is suitable as a demonstration for high school or college level electronics students. It is not designed for direct student participation, but could be student involved.

Time Needed For This Activity: 1-2 Classroom Hours

Occupational Areas:

Manufacturing
Power & Energy

Equipment and Supplies Necessary for This Activity:

Two types of equipment are needed for this demonstration. First, the equipment needed to prepare the samples for viewing. If this equipment is not available, it might be possible to have the samples prepared by a metal testing or materials laboratory. The only other piece of equipment is a high-powered microscope, available from the science department in most high schools and colleges. The following equipment is required:

1. Samples of soldered connections, including both correctly soldered and incorrectly soldered ones.

2. Casting plastic resin, such as that used for preparing metal samples for study under the microscope.

3. Grinding and polishing disc, with abrasive paper and liquid abrasives up to about 1000.

4. Microscope up to 1000 power, with suitable light source.

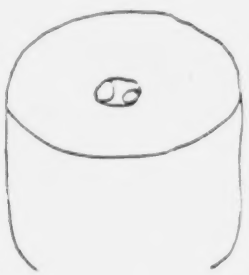
Introduction:

Soldering is best defined as a joining process in which coalescence between two metal parts is produced by an alloy whose melting temperature is below the melting temperature of the base metal being soldered. Solder alloys whose melting temperature is less than 800° F are further classified as soft solder. For electrical work, an alloy of 60% tin and 40% lead is often used.

This alloy melts at 374° F, and has a very small pasty range, the temperature between solid and liquid conditions. Its electrical conductivity is satisfactory for most electrical connections. In order to aid the soldering process, the solder is often manufactured with a rosin flux in the center and sold as rosin-core solder.

Procedure:

The examples of soldered connections are prepared by soldering two twisted pieces of heavy copper wire together. At least one acceptable connection should be prepared, as well as several poor joints (cold solder, rosin-insulated, air bubbles, etc.). These samples are then cut crosswise and embedded in liquid casting resin. When the resin has solidified, the samples are ground and polished until a cross-section of the soldered connection is clearly visible (see diagram below).



Each sample is then examined under the microscope to allow students to view the bond which has resulted between the solder alloy and the base material. At low powers, defects in bonding, such as cold solder or rosin insulation will be visible, while high power will show the bond resulting from proper soldering techniques.

Data:

Students may be asked to describe their observations or the different samples, either orally or in writing.

Questions:

Class discussion of each of the samples should result in questions about the bonding between the solder and the base material, as well as the failure to bond in some of the samples. Bonding can best be described as a chemical bond produced by a metal solvent action. The solder dissolves (not melts) a small amount of base material to form an intermetallic compound. When the solder solidifies, it is held together by the same attraction between adjacent atoms that hold a piece of solid metal together. Students who would like a more detailed explanation of the soldering process can be directed to any of the references listed later.

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. How were materials connected in early times?

   b. When were soldering techniques developed?

   c. How was the process changed?

2. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   a. Identify tools and procedures.

   b. Identify safety procedures.

3. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Identify process to properly solder.

   b. Identify materials and new materials.

4. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   a. Identify any new developments in the field and discuss or report.

EVALUATION: Was a proper solder connection made? Will connection work?

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	Dissimilar materials.
2. Mathematics concepts	
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	Heat, capillary action, conductivity, electricity.
4. Awareness of human elements of technology-societal implications	
5. Communications skills	
6. Safety and health	Safe work habits.
7. Psychomotor skills	
8. Career-related information	Who performs this?
9. Creative problem solving	Proper set-up.
10. Transfer of learning	Where can the student use this information?

RESOURCES:

Contact Person: Gary Davidson
Robert Grey Middle School
Portland Public Schools
280-5676

REFERENCE BOOKS AND CATALOGS:

Brady, George S, Materials Handbook. New York: McGraw-Hill Co, 1963, 9th Edition, pages 691, 704-705.

Brazing Manual. New York: American Welding Society, 1963, page 1-64.

Clauser, H R, Editor-in-Chief, The Encyclopedia of Engineering Materials and Processes. New York: Reinhold Publishing Corp, 1963, pages 628-631.

Keyser, Carl A, Materials Science in Engineering. Columbus, Ohio: Charles E Merrill Publishing Co.

INDUSTRIAL ARTS/TECHNOLOGY

HEAT CONDUCTIVITY OF DIFFERENT TYPES OF STEEL

Description of Activity:

Comparing the heat conductivity of stainless steel and carbon steel.

Time Needed For This Activity: 10 Classroom Minutes

Occupational Areas:

Manufacturing
Power & Energy

Equipment and Supplies Necessary for This Activity:

- Strip of non-magnetic stainless steel, 8" long, 1" wide (possibly available from school metal shop as molding for cabinets, or from local metal working shop or hardware store as stainless strip trim)
- Strip of low-carbon steel, same size (packing box strapping or metal cabinet sheet steel)
- Eight 1/8" cubes of apraffin or slices of wax crayons (eight 1/8")
- Ring stand
- Meeker or Bunsen burner

Experiment:

Mount a strip of stainless steel and a strip of low-carbon steel horizontally in a V-shape by fastening one end of each in a ring stand clamp. Place four cubes of paraffin on each strip at about two-inch intervals. Apply heat from meeker or Bunsen flame evenly along each strip as the paraffin melts. Which type of steel is the better heat conductor?

Industrial Applications:

By combining metals with differing heat conductivities, the modern pots and pans utilized by today's housewife heat quickly and evenly in the parts where food is cooked while the handles remain relatively cool. Parts of machines may likewise be designed to resist or to conduct heat. For example, heating and refrigerating units can be made more efficient by using metals having the proper heat conductivity for the different parts.

Background Technical Information:

Heat conductivity varies widely in metals. The mechanism of thermal conduction is probably at least threefold. Atoms and molecules agitated by heat actually vibrate against each other and mechanically pass along the heat energy. Thermal radiation between neighboring atoms and molecules has a similar result. Yet, neither of these explains the great difference in conductivity between silver and lead which are both soft, crystalline metals with similar chemical properties. If we examine the electrical conductivity of these and other metals we find that there is a close correlation between thermal and electrical conductivity. This seems to indicate that the third factor in heat conduction depends on the activity of electrons.

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. Identify early conductors.

   b. Identify how conductivity was discovered.

2. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   a. Use safe and proper work habits.

3. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Discuss and use proper scientific methods.

4. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   a. Identify how conductivity is important to society.

   b. Discuss what impacts new developments in superconductivity will have upon society and technology.

EVALUATION: Neatness, completeness of report, accuracy of data.

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	
4. Awareness of human elements of technology-societal implications	
5. Communications skills	
6. Safety and health	
7. Psychomotor skills	
8. Career-related information	
9. Creative problem solving	
10. Transfer of learning	

RESOURCES:

Contact Person: Gary Davidson
Robert Grey Middle School
Portland Public Schools
280-5676

INDUSTRIAL ARTS/TECHNOLOGY

AN INSTRUCTIONAL UNIT ON DIELECTRIC TESTING

Description of Activity:

Dielectric materials, sometimes called insulators, are one of the most important and widely used groups of electrical materials. They are used in all electrical circuits and equipment for purposes of insulation, separation, and packaging. This instructional unit is designed to help students better understand this important group of materials and their applications in the electrical and electronic fields. It is suitable for use as a demonstration at all grade levels, or as a student experience at the high school or college level.

Time Needed For This Activity: 1 Classroom Week

Occupational Areas:

Power & Energy

Equipment and Supplies Necessary for This Activity:

Please see attached for suggestions.

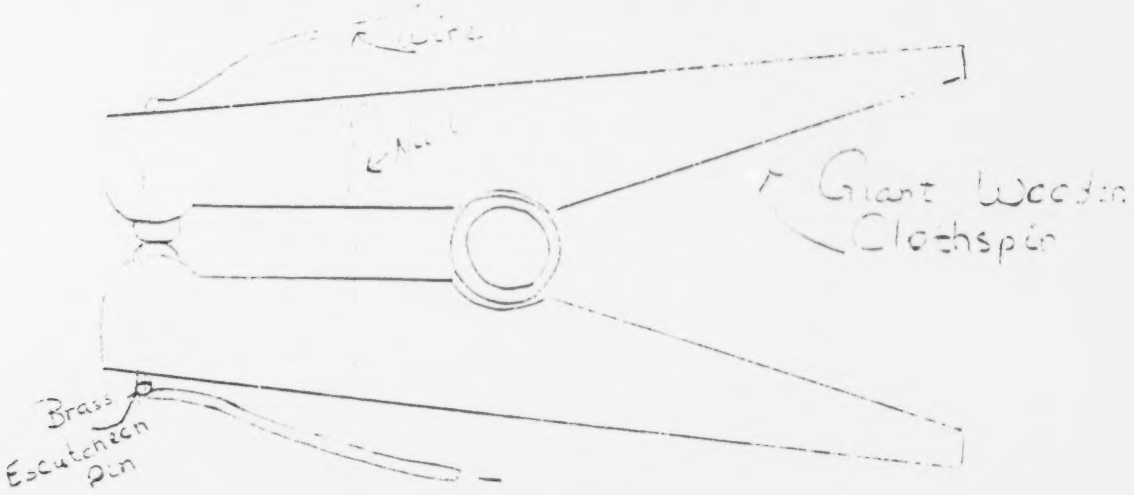
Introduction:

In this unit, several commonly used dielectric materials will be subjected to an increasing electronical pressure or voltage. The point at which this voltage overcomes the insulating ability of the material, known as the dielectric breakdown point, is measured and recorded. This way, students can compare the behavior of different types of material or different thicknesses of the same material. They may also test the dielectric breakdown of certain electrical components, such as capacitors.

Equipment:

The equipment required for this demonstration or student experiment is not critical, and substitutions may be made as necessary. The electrode holder and clasp was made by the author, and many variations of this device are possible.

1. DC power supply, high-voltage, variable, 0 to 1000 volts.
2. DC milliammeter or VOM, 0 to 10 mA.
3. DC voltameter, VOM, or VTVM, 0 to 1000 volts.
4. Resistor, 100,000 ohms, 1 watt.
5. Electrode holder and clamp (see drawing below)



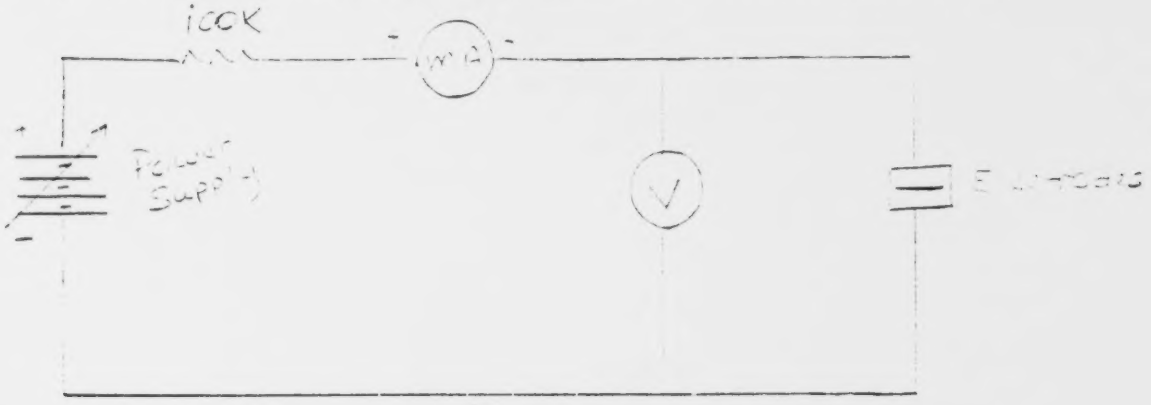
The above electrode holder was made from a giant wooden clothespin, available in stationary stores. The ends were drilled and fitted with #16 x 1" escutcheon pins which were filed flat and parallel. A nail was inserted near the spring to keep the contacts aligned and parallel. The only requirement for an electrode holder is that the electrodes must be flat, parallel, and lightly pressing against the dielectric sample. They must be round and free of sharp edges or projections.

Materials:

Thin dielectric or insulating materials are required for this experiment, unless the voltage is raised to several thousand volts (a hazard to students and instructor). Materials such as polyethylene, mylar, paper, cellophane, was paper, and mica are suitable, provided they are thin enough to be broken down at less than 1000 volts DC. Students are always willing to collect materials around the home for testing. Capacitors may be taken apart to test the dielectrics used in their manufacture. Commercial capacitors may be tested as a unit by connecting their leads in place of the electrode holder. Electrolytic capacitors are not suitable for testing by this method.

Procedure:

Using the equipment listed previously, connect the circuit shown below.



Since the voltages are high, extra care is required to avoid electrical shock. Do not omit the 100K resistor. This resistor limits current to a safe level and prevents an explosion when breakdown of the dielectric occurs. It does not affect the measurements desired.

Place the sample to be tested between the electrodes and allow them to clamp down onto the material. Starting at zero, gradually increase the applied voltage until the milliammeter indicates current flow. The voltage observed at the moment before current starts to flow is the dielectric breakdown voltage of that sample. As breakdown occurs, the voltmeter reading will drop to zero because the path between the electrodes has been completed. Run several trials with each material, and record the results. If an audio indication of breakdown is desired, a table radio playing nearby will crackle with static when breakdown occurs.

Data:

Students should try to identify each material tested. Materials obtained from commercial capacitors should be identified by tape and voltage rating of the capacitor. On a chart such as the one below, identify the material and record the measured voltage at breakdown for each trial.

Material	Trial 1	Trial 2	Trial 3	Trial 4
Wax Paper	540V	500V	550V	560V
Cellophane	1200V	1200V	1160V	1250V

If commercial capacitors are tested, record the breakdown voltage obtained for each unit. It should be emphasized that this is a destructive test, and each capacitor or dielectric will be damaged beyond further use.

Calculations:

If dielectric samples of known thickness are available, it may be possible to calculate the "volts-per-mil-thickness" rating by dividing the thickness in mils into the average of the voltages obtained.

Questions:

Questions relating to the behavior of insulating materials under various conditions may be answered from the data obtained in the experiment and elated reading in the references listed below. Questions relating to the strongest material, the effect of thickness on the breakdown point, the effect of moisture in the material tested, and other similar questions are frequently asked.

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore, utilize, and manage the resources necessary for technology (people, tools, machines, knowledge, capital, materials, energy, and time).

   a. Identify and define dielectric materials.

   b. Use tools to assemble experimental study.

2. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   (Objectives covered in this activity under this goal):

   a. Problem-solve set-ups.

   b. Problem-solve uses of dielectrics.

   c. Show why dielectrics are important in technology.

3. Explore and develop understanding of the systems of technology, how systems are controlled, and how systems are used to solve problems.

   (Objectives covered in this activity under this goal):

   a. Show several uses of dielectrics.

4. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   a. Show how dielectrics affect our daily lives through hands-on experimentation and documentation.

EVALUATION: Accurate documentation of lab. Report on dielectrics and their uses.

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	Insulation/electrical.
4. Awareness of human elements of technology-societal implications	
5. Communications skills	
6. Safety and health	Safe use of insulators.
7. Psychomotor skills	
8. Career-related information	
9. Creative problem solving	Correct testing and reporting procedures.
10. Transfer of learning	Daily life, uses, construction of devices.

RESOURCES:

Contact Person: Gary Davidson
Robert Grey Middle School
Portland Public Schools
280-5676

REFERENCE BOOKS AND CATALOGS:

Baker, W P, Electrical Insulation Measurements. New York: Chemical Publishing Co, Inc, 19655. Pages 61-69.

Condon, E U, PhD, Editor, Handbook of Physics. New York: McGraw-Hill, 1958. Pages 4-6, 4-9 to 4-10, 4-103 to 4-122, 8-51, 8-96 to 8-97.

DeMaw, Doug, Editor, The Radio Amateur's Handbook. Newington, Conn: American Radio Relay League, 1970. Pages 16, 23.

Herrington, Donald and Stanley Meacham, Editors, Handbook of Electronic Tables and Formulas. Indianapolis, Ind: Howard W Sams Co, Inc, 1962. Pages 51, 83.

ITT, Reference Data for Radio Engineers, 9th Edition. New York: Howard W Sams Co, Inc, 1969. Pages 5-16 to 5-28.

Orr, William I, Radio Handbook, 18th Edition. New Augustin, Ind: Editors and Engineers, Ltd, 1970. Pages 27, 29, 37-39, 40-42.

Mantell, Charles L, Editor-in-Chief, Engineering Materials Handbook. New York: McGraw-Hill, 1958. Pages 19-2 to 19-8.

Weast, Robert C, PhD, Editor-in-Chief, Handbook of Chemistry and Physics. Cleveland, Ohio: The Chemical Rubber Co, 1965. Pages 3-4, E-50 to E-55, F-58.

SECTION 5

CONSTRUCTION ACTIVITIES (TLA)

INDUSTRIAL ARTS/TECHNOLOGY LEARNING ACTIVITY

PAPER CONSTRUCTIONS: PROBLEM-SOLVING WITH LOAD-BEARING STRUCTURES

Description of Activity:

This technology learning activity contains three low-cost activities that introduce students to problem-solving, structural design, and material processes. Each activity involves the student in increasing the structural strength of a sheet of paper through design and processing to solve a load-bearing problem.

Time Needed For This Activity: 1 Classroom Hour Per Activity

Occupational Areas:

Construction

Equipment and Supplies Necessary for This Activity:

Ditto paper
Tape
Staples
Glue
Scissors
Exacto knife

Paper Constructions - Teacher's Information:

These technology learning activities are good introductions to the principles of engineering design and material processes. You can start the unit by holding up a piece of paper and asking "What is this?" The response you want is: (1) paper, which is the material; and (2) sheet, which is the form that the material is in. Then ask for other types of sheets; i.e., sheet of plywood, sheet steel, sheet of plastic, cloth sheets, etc.

You can lift up a piece of paper so it won't hold up its own weight and then ask them to describe the dynamics of the material in its present form. The answers will be "flimsy", "weak", etc., because it can't even hold its own weight. Then try to separate the paper by pulling it apart across its plane, which is very hard for a human to do, or have a student grab one end of it and drag her across the floor while she sits on a chair. Take a piece of paper and fold it down the middle so it forms a V shape and suddenly this sheet of paper will not only hold itself, but will also hold a pen or pencil.

The dynamics of sheet material have similarities, such as high tension strength and low compression strength. By modifying materials to take advantage of their properties, the engineer can build tall towers, strong structures and long bridges. The modification of materials is the base for all engineering related fields.

The next thing is to hold up tape, glue, and staples and ask "What are these and what are they used for?" They are bonding agents and are used to bond materials together. In this unit we will be bonding similar materials together, but we can also bond dissimilar materials. Ask for other ways to bond; i.e., welding, nails, screws, sewing, etc.

Then hold up a pair of scissors or an exacto knife. These are parting tools such as saw, cutting torch, water jets, laser scalps, etc.

If you can manipulate this material and use these bonding agents and parting tools to their best advantage, then you can transfer this knowledge to building a structure out of steel, welding and torch, or wood, nails, and saws.

MAJOR INDUSTRIAL ARTS/TECHNOLOGY GOALS AND OBJECTIVES EMPHASIZED:

Each student will:

1. Explore and experience the evolution of technology for the purpose of developing a historical perspective.

   (Objectives covered in this activity under this goal):

   a. Research and report early construction materials and techniques from Romans to present.

2. Explore and experience how people use technology to solve problems through planning, designing, illustrating, modeling, and producing.

   a. Identify how many groups or systems must work together to construct a project of some multitude.

3. Develop an understanding of the impacts of technology upon their lives, culture, and environment. Explore their responsibilities for the control of technology based upon its capabilities and limitations.

   a. Show how engineering is applied to construction today.

   b. Identify how technology is changing construction of many items.

EVALUATION: Determine how strong paper structures will be using plain paper, paper staples and glue (how much weight will it hold).

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	Measurement and use of percentage to evaluate solutions.
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	Exploration of the material properties of tension strength and compression strength.
4. Awareness of human elements of technology-societal implications	Societal implications.
5. Communications skills	
6. Safety and health	
7. Psychomotor skills	
8. Career-related information	Exploration of the engineer's role project design.
9. Creative problem solving	Apply problem-solving processes.
10. Transfer of learning	

RESOURCES:

Contact Person: John Granger
Warrenton High School
861-3317

REFERENCE BOOKS AND CATALOGS:

Kjell-Jon Rye
Technology Teacher
Bellevue High School
Bellevue, WA

INDUSTRIAL ARTS/TECHNOLOGY LEARNING ACTIVITY

THE EFFECT OF MOISTURE CONTENT ON THE STRENGTH OF WOOD

Occupational Areas:

Construction

Questions:

What is the fiber saturation point in wood?
How does the strength of wet wood compare with that of dry wood?
What factors are responsible for the increase in strength when wood is dried?
How is the moisture content of wood determined?

Wood, when green, contains large amounts of moisture varying from 30-40% of the dry weight of the wood in pine heartwood to over 200% in some other species. Part of this moisture is absorbed in the cell walls and part in the cell cavities, somewhat like free water in a container. As wood is dried, the water in the cell cavities is first given off, completely emptying them. At this point, the cell walls are fully saturated and the cavities empty, the moisture condition of the wood is known as the "fiber saturation point". It varies from 25-35% moisture content.

Increase in wood strength does not begin until the moisture content has gone below the fiber saturation point. From this point on, most strength properties of wood increase rapidly as moisture content decreases. This is due to two causes:

1. Actual strengthening and stiffening of the cells walls as they dry out.

2. Increase in the compactness of the amount of wood substance in a given volume because of the shrinkage which accompanies drying below the fiber saturation point.

When wood is dried down to 5% moisture content, its density is often increased from 2.5% to 20%. Its bending strength and end-crushing strength may be doubled or tripled as a result of this drying.

A simple method for computing the moisture content of any small piece of wood involves the use of the formula:

$$\text{Percent moisture content} = \frac{\text{original weight of sample - oven dry weight}}{\text{oven dry weight}} \times 100$$

First weight of sample of wood in question, then dry it at the boiling point of water until it has reached a constant oven dried weight. This weight is subtracted from the original weight and the figure divided by the oven dried weight. The moisture content thus obtained is based on the oven dried weight of the wood.

RESOURCE:

Contact Person: Gary Davidson
Robert Gray Middle School
Portland Public Schools
280-5676

SECTION 6

MISCELLANEOUS ACTIVITIES (TLA)

INDUSTRIAL ARTS/TECHNOLOGY

JOB APPLICATION

Description of Activity:

In this activity, students will analyze a job application, compile the needed personal information to complete an application, and produce a final draft of their application. An additional activity allows students to observe several students involved in a job interview.

Time Needed For This Activity: 2-3 Classroom Days

Occupational Areas:

Communication

Equipment and Supplies Necessary for This Activity:

Blank application forms (at least 2¼ times the number of students involved in the activity)
Table
2 chairs
Seating for class

Job Application Activity:

A job application is the employers' first introduction to many potential workers. It provides many facts about an individual's family, study and work history. The completeness of this information indicates how carefully a person has prepared. It also indicates the quality of work a person can do and how organized they can be.

Many people feel very uncomfortable filling out a job application for the first time. This activity gives the student practice in completing an application. Stress can be given to use of a student's academic skills.

Day 1: Teacher will explain activity, distribute application form (working copy), describe sections of application form, related information required.

Student will discuss activity information, application form, related information.

Assignment: (Homework due next class period) Complete working copy of job application.

Day 2: Teacher will identify common mistakes and corrections on application forms, distribute final copy of application form, assist students in completion of final copy, evaluate work done.

Students will edit working copy of application, complete final copy of application (due at end of period).

*Day 3: Teacher will explain interview process, identify students to interview from job applications or volunteers, conduct one interview and discuss, conduct second interview and compare.

* This is an excellent chance to include the principal, etc., in a technology activity.

JOB APPLICATION

Position Applied For				Date
Name in Full Mr. Mrs. Miss	Last	First	Middle	Other Name Used	SS #
Number & Street	City	State	Zip	Phone
In Case of Emergency Notify	Name			Relationship
	Address			Phone

EDUCATION

Type of School	Name and Address	Yrs. Attended	Year Left	Graduated	Course or Major
Grammar or Grade					
High School					
College					
Business or Trade					

SKILLS

What Kind of Work Can You Do	Typing Speed
What Machines Can You Operate	Shorthand Speed

PRIOR WORK HISTORY

List in Order, Last or Present Employer First

May We Call Your Present Employer ☐ Yes ☐ No

Dates From	To	Employer	Rate of Pay Start	Rate of Pay Finish	Job Title & Supervisors Name	Reason for Leaving
		Name Address				
		Name Address				

REFERENCES (Other than Relatives or Former Employers)

	Name	Address	Occupation
1.			
2.			

It is agreed and understood that any false statements on this application may be considered sufficient cause for dismissal when discovered.

Signature _____

EVALUATION: Participation in activity, completeness of application, neatness and quality of work. Have principal or counselor act as interviewer or reviewer of applications

INTERDISCIPLINE AREAS	LEARNING CONSTANTS OR THEORIES APPLIED
1. Systems of technology	
2. Mathematics concepts	
3. Science concepts - Explore aerodynamic forces, inertia, fraction, and thrust	
4. Awareness of human elements of technology-societal implications	Appropriate questions.
5. Communications skills	Verbal communications.
6. Safety and health	
7. Psychomotor skills	Body language.
8. Career-related information	Job application process.
9. Creative problem solving	
10. Transfer of learning	Relating skills of job requirements.

RESOURCES:

Contact Person: Larry Wilson
Gregory Heights Middle School
Portland Public Schools
280-5600

REFERENCE BOOKS AND CATALOGS:

Career Horizons Program
Portland Public Schools

BIBLIOGRAPHY OF
TECHNOLOGY EDUCATION
CURRICULUM MATERIALS
1987-1988

Code (1) = Recommended

- Auer, Herbert J, Dr, "Robotics" Instructional Manual, Industrial Technology Department, University of North Dakota, 1985.

  Instructions and activity packets adaptable to any lab configuration.

- Auer, Herbert J, Dr, "Photovoltaic" Instructional Manual, Industrial Technology Department, University of North Dakota, 1985.

  Instructions and activities for the secondary level, originally designed for a mobile laboratory.

- Baker, Tommy G, "Plastics Technology", Extension Instruction and Materials Center, Division of Continuing Education, University of Texas at Austin, 1984.

  Plastics Technology is a package designed for junior or mid-high students in an 18-week unit, and is exploratory in nature. Includes outcomes, materials, content, activities, and evaluation. It can be broken out into smaller units of instruction.

- Barnes, James L, "Manufacturing Technology", Extension Instruction and Materials Center, Division of Continuing Education, University of Texas at Austin, 1984.

  Manufacturing Technology is designed for junior high/middle school and is developed for 18 weeks of study, but can be broken down into smaller units of instruction. Is assembled in the style of the Plastics Technology package.

- California State Department of Education, "Industrial Technology Education", Model Curriculum Standards and Program Framework, Vocational Education Division, 721 Capitol Mall, Sacramento, CA 95814, (916) 445-6726, Draft-October 1986.

  Contains program standards meshed with basic curriculum for 10 technical areas.

- Cheng, Wan-Lee, Dr, "Computer Aided Design", Industrial Technology Department, University of North Dakota, 1985.

  Instructional manual and activity packets inclusive. Originally designed for a mobile laboratory.

- Eickhoff, Luvern R, Dr, "Laser and Fiber Optics", Industrial Technology Department, University of North Dakota, 1985.

  Instructional manual and activity packet inclusive. Originally designed for a mobile laboratory.

(1)
- Illinois State Board of Education, "Technology Education", Adult, Vocational and Technical Education, 1984.

  A curriculum designed for grades 9-10 in technology education. Classroom ready materials in individual course units in: Transportation Technology, Production Technology, Introduction to Energy Utilization Technology, Communiation Technology, a planning guide. Available, Illinois State Board of Education, 100 N 1st St, Springfield, Illinois 62777, (217) 782-4321.

(1)
- Iowa Curriculum Assistance Systems (ICA), "Technology Education", Iowa Department of Public Instruction, 1986.

  Technology Education - Teacher and student manuals designed for classroom ready use at the high school level in technology, in the areas of manufacturing, energy and power, graphic communications, transportation. Includes floppy disks and slides for curriculum support materials.

- Kozak, Michael R, "Metalworking Technology", Extension Instruction and Materials Center, Division of Continuing Education, University of Texas at Austin, 1984.

  Metalworking Technology is designed for use in exploratory junior high/middle school programs. Material is designed to be delivered in 18 weeks; however, it can be broken down into smaller units of instruction. It is organized well and has objectives, vocabulary, teaching aids, references, outline, materials, and suggested activities and tests.

(1)
- New York, University of, "Introduction to Technology", New York State Department of Education, Albany, New York 12234, model seventh grade technology learning activities, June 1986.

  Assembled in modules T-1 through T-5 starting with Early Technical Devices in T-1 to Habitats in an Alien Environment in T-5. Completely away from traditional I.A. programs.

(1)
- New York, University of, "Introduction to Technology", New York State Department of Education, Albany, New York 12234, sample eighth grade technology learning activities, June 1986, for field testing (to be revised July 1, 1987).

  Assembled in modules T-6 through T-10, with review activities at the beginning. Selected topics and activities include: optimizing resources in existing transportation systems, energy resources, satellite communication, clear air, and others.

- Sinn, John W, Dr, "Computer Numerical Control", Instructional Manual, Industrial Technology Department, University of North Dakota, 1985.

  Instructions and learning activities in CNC programming, could be done without machinery.

- Thode, Brad, "Technology Education", Idaho State Division of Vocational Education, 1987.

  This packet contains six modules related to technology. Each module contains six technology related tasks. All of the modules contain tasks and activities related to the four clusters of manufacturing, building construction, communications, and power/transportation. Contains ideas for implementation and is designed for 80% hands-on. For more information, contact Wood River Junior High, Brad Thode, PO Box 1088, Hailey, Idaho 83333, (208) 788-3523.

(1)
- Utah State Office of Education (titles below): Office of Vocational Education, 1985, 250 E 600 S, Salt Lake City, Utah 84111.

  - "CAM - Computer Aided Manufacturing"
  - "Photovoltaic Technology"
  - "Computer Technology"
  - "Satellite Technology"
  - "CAD - Computer Aided Drafting Technology"
  - "Robotic Technology"
  - "Laser Technology"

  Each of the above is an individual unit of learning activity packets of varying numbers. The material can be used for junior high or high school technology programs. Objectives and competencies are integral parts of each packet. Good

- Winek, Gary, Dr, "Woodworking Technology", Extension Instruction and Materials Center, Division of Continuing Education, University of Texas at Austin, 1984.

  Woodworking Technology is aimed at the junior high level for 18 weeks of study, but can be broken down into smaller units. Is well organized and contains many needed helps and aids.

Rating Code: #(1) = Recommended
#(2) = Acceptable

Texts

(2)
• Bame, Cummings, "Exploring Technology", Davis Publications, 1980, ISBN 0-87192-112-X.

What is technology, processing technology, energy and power, manufacturing, construction, transportation, communication, automation, consequences of technology.

(1)
• Hacker, Michael and Robert Barden, "Technology in Your World", Delmar, 1987. ISBNO-8273-2655-6 and 0-8273-2656-4. A companion text to the technology learning activities developed by New York State.

Covers: Creating our Own World, Resources for Technology, Choosing the Right Resources, Processing Resources, Systems and Problem-Solving, Electronics and Computers, Communication Systems, Production Systems - Manufacturing, Production Systems - Construction, Transportation, Biotechnical Systems, Controlling the System, Impacts, and Outlooks.

(2)
• Heiner, Hendrix, "People Create Technology", Davis Publishing, 1980, ISBN 0-87192-109-X. Contains: Technology and You; Creators of Technology, Tools of Technology, Resources of Technology, Procedures of Technology, Systems Resulting from Technology, Products and Problems Relating from Technology, Technology on the Move.

(2)
• Todd, McCrory, Todd, "Understanding and Using Technology", Davis Publishing, 1985, ISBN 087192-165-0.

Covers: Elements of Technoloy - Tools, Materials, Processes, Energy, Information, Humans; The Activities of Technology - Constructing, Transporting, Communications, Producing; Changes of Technology - Exploring, Developing, Controlling, Futures, Consequences, Decisions.

(1)
• Williams, Badrkhan, Daggett, "Technology at Work", Southwestern Publishing, 1987, ISBN 0-538-16300-3.

Covers: Roles of Technology; Putting Technology to Work: The Systems Approach: Systems Technology; Monitoring, Control, and Feedback Systems; Energy Principles and Sources; Electricity/Electronics; Manufacturing Systems; Transportation and Distribution Systems; Construction Systems; Communication Systems; Information Processing; Space Systems; health Systems; Chemical Systems; Agritechnology Systems; Food Processing Systems.

(1)

- Williams, Badrkhan, Daggett, "Technology for Tomorrow", Southwestern Publishing, 1987, ISBN 0-538-16250-3.

  Covers: The Effects of Technology, Technology and Change, Human and Natural Resources, Tools and Mechanisms, Power, Energy, Structures, Agritechnology Products, Agritechnology - Methods, Health Care, Health Maintenance, Information Systems, Computer Systems, Computers and Change, The Systems Approach - Putting Technology to Work, Technology at Work.

TECHNOLOGY EDUCATION ACTIVITIES

Volume 3 - #1 February, 1988

TABLE OF CONTENTS

Code Number*	Title
CM-G-006	Light Wave Communication - Photophone
CM-G-020	Newspapers and Change
CM-E-009	Hard-Wired Communication: Electronic Telegraph
CM-E-023	Laser Characteristics: Reflective Properties
CM-I-002	Types of Computers
CM-R-015	Relief Printing
CO-P-011	Developing Specifications - Wood Frame
CO-P-020	Making a Project Plan
CO-P-021	Testing Concrete for Slump
CO-W-031	Producing Reinforced Concrete
CO-W-032	TEA Wiring Panel
CO-W-033	Installing Electrical Syustems
CO-W-034	Installing Electrical Devices
MF-E-019	Documenting Production Plans
MF-E-021	Introduction to Research and Development
MF-M-023	Bend Test - Wood
MF-P-019	Engle Casting
MF-P-022	Slush Casting
MF-P-032	Bonding and Mechanical Fastening
TR-G-013	Research and Development in Transportation
TR-G-014	TEA Wind Tunnel
TR-D-018	Designing Aerodynamic Vehicles
TR-O-007	Effects of Fuels on Engine Performance
EN-G-016	Controlling Power
EN-D-017	Energy Utilization Audit

* A chart of code numbers is on the next page.

TECHNOLOGY EDUCATION ACTIVITY CODES

General Technology

GT-H-xxx	Evolution of Technology
GT-C-xxx	Contemporary Technology
GT-F-xxx	Technology in the Future

Communication

CM-G-xxx	General Communication
CM-E-xxx	Electronic Communication
CM-P-xxx	Photographic Communication
CM-R-xxx	Printed Graphic Communication
CM-T-xxx	Technical Graphic Communication
CM-I-xxx	Information Processing

Construction

CO-G-xxx	General Construction
CO-P-xxx	Construction Planning and Design
CO-W-xxx	Constructing Structures
CO-C-xxx	Community Planning

Manufacturing

MF-G-xxx	General Manufacturing
MF-M-xxx	Manufacturing Materials
MF-P-xxx	Manufacturing Processes
MF-E-xxx	Manufacturing Enterprise

Transportation

TR-G-xxx	General Transportation
TR-D-xxx	Designing Transportation Systems
TR-O-xxx	Operating Transportation Systems
EN-G-xxx	General Energy
EN-D-xxx	Designing Energy Systems
EN-O-xxx	Operating Energy Systems

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